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DRAFT ENVIRONMENTAL IMPACT STATEMENT

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Application to Amend Plan of Operations and Permit No. 00118

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CHAPTER 1 - INTRODUCTION

1.1 Project Location and Background

The Stillwater Mining Company (SMC) a partnership between Manville Mining Company and Chevron U.S.A., Inc. acting through its agent, The Pittsburgh and Midway Coal Mining Company is operating an underground platinum/palladium mine in Stillwater County, Montana (Figure 1.1-1). The closest community is Nye, Montana, which is approximately 5 miles northeast of the mine site.

Currently SMC has approval to operate the mine with a nominal ore production rate averaging 365,000 tons per year (tpy), or 1,000 tons per day (tpd). The ore is upgraded on site by crushing, grinding, floating, and drying to obtain a dried concentrate. Approximately 62 percent of tailing created during the milling process is returned underground for use as backfill in mined out stopes. The remaining 38 percent is disposed of in a lined tailing impoundment adjacent to the mine and mill facility. The dried concentrate is shipped by truck to a smelter located in Columbus, Montana, for further processing to the matte stage. The smelter matte is subsequently shipped to Belgium for refining.

SMC's original plan of operations and permit were approved after distribution of a Final Environmental Impact Statement and Record of Decision, jointly written by the Department of State Lands and the Custer National Forest (DSL/FS, 1985). The current proposal, if approved, would be the eighth amendment to the original plan of operation and permit. The following is a summary of all previously approved amendments.

Amendment 001 was approved and permitted June 30, 1986. This amendment relocated mine and mill facilities. No increase in permit area or disturbed area resulted.

Amendment 002 was approved and permitted September 8, 1986. This amendment allowed excavation of a sand borrow area. No increase in permit area was allowed and the disturbed area was reclaimed.

Amendment 003 was approved and permitted January 8, 1987. This amendment allowed excavation of a second sand borrow area. No increase in permit area was allowed and the disturbed area was reclaimed.

Amendment 004 was approved and permitted February 24, 1987. This amendment relocated the southern portion of the tailing impoundment toe dike. No increase in permit area was allowed. This amendment shifted the toe dike to higher ground along Mountain View Creek and previously disturbed land.

Amendment 005 was approved and permitted March 2, 1989. This amendment was the first major amendment since the original permit. It increased the permitted acreage to 1,158 and permitted mining on the east side of the Stillwater River. The total allowable disturbance was increased by 72 acres.

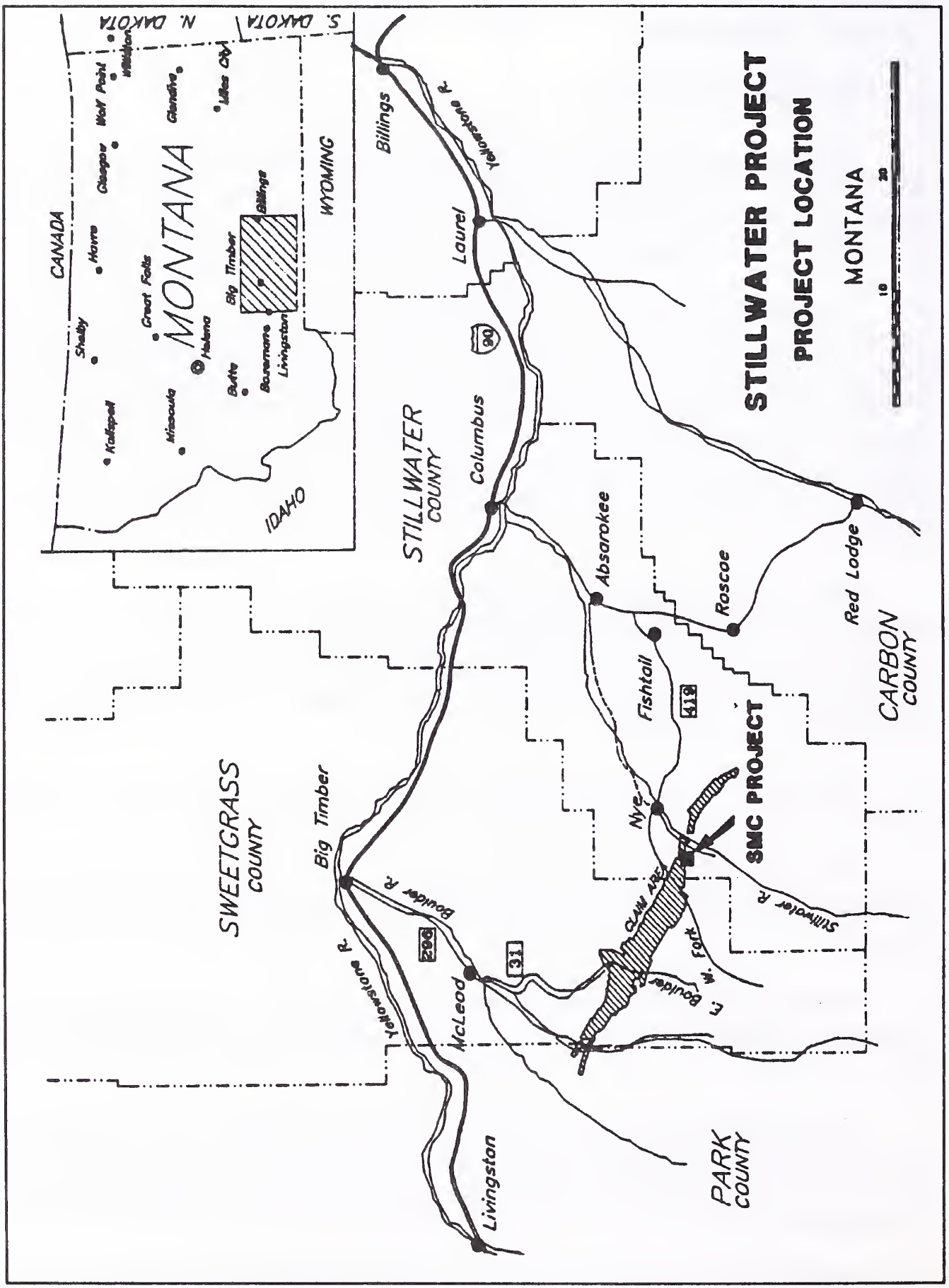

Figure 1.1-1 Stillwater Project Location

Amendment 006 was approved and permitted July 21, 1989. This amendment was for construction of a temporary sand slurry pipeline connecting the east and west sides of the mine area. No increased permit or disturbed area was allowed.

Amendment 007 was approved and permitted November 15, 1990. This amendment was for construction of the three Stillwater Valley Ranch percolation ponds and 4 monitoring wells. The permit area was increased 27 acres with 7 acres of disturbance.

In addition, SMC requested that it be allowed to relocate the 5900 adit southward onto private land to visually hide it from almost all public view. After SMC acquired the landowner's permission, the agencies administratively extended the permit area by 48 acres with 2 acres disturbed. No environmental assessment was necessary because the impacts of the adit construction had previously been analyzed, disclosed and approved under NEPA/MEPA rules.

Total permit area is 1233 acres with a potential 245 acres disturbed. However, because of ongoing reclamation and staged development, only 140 acres are presently disturbed. The environmental analyses and decision documents of all previous amendments are incorporated by reference into this environmental analysis.

1.2 Brief Summary of the Proposed Action

SMC has submitted an amendment to the current plan of operations which proposes to increase the mine production rate to 730,000 tpy (2,000 tpd), with the anticipated production period remaining at about 18-20 years. In order to achieve this goal SMC has proposed the following changes to their plan of operations.

Enlargement of the existing tailing impoundment capacity to allow disposal of additional tailing slimes for a period of 18-20 years at the new production rate of 730,000 tpy.

Disturbance of an additional 35 acres within the current permit boundary for uses such as waste rock storage, mining storage, new building and visual berm construction.

Expansion of the milling system, tailing disposal system, sewage treatment system, and employee vehicle parking lot.

Relocation of the mill complex main entrance, security building, and mine equipment/truck shop, warehouse, and mill maintenance shop.

Incremental addition from the current level of 364 (460 permitted) full-time employees up to an ultimate employment of 525 persons.

A petition to change ambient water quality for total dissolved solids, ammonia, nitrates and metals in both surface and groundwater.

Please refer to Chapter 2, section 2.3 of this document and the application regarding specific details of the proposed action.

1.3 Purpose and Need for Action

SMC has submitted a proposal to amend its plan of operations in accordance with Federal and State regulations. The General Mining Law of 1872 grants all U.S. citizens the right to explore, develop, and produce mineral resources on federal lands open to mineral entry. SMC operates the only economically viable platinum/palladium mine in the western hemisphere. The Stillwater Mine accounts for five percent of world production. To better compete against the former Soviet Union and South African sources, SMC wishes to increase production, thereby lowering its unit costs.

This document has been jointly prepared by the Custer National Forest (CNF) and the Montana Department of State Lands (DSL) in cooperation with the Department of Health and Environmental Sciences (DHES) in response to the plan of operations amendment proposed by SMC. The document has been prepared in compliance with the Montana Environmental Policy Act (MEPA) and the National Environmental Policy Act (NEPA).

The purpose of this Environmental Impact Statement (EIS) is to disclose the environmental effects of potential agencies' decisions regarding SMC's proposed mine plan amendment, and alternatives to the proposed amendment. In addition, this EIS will evaluate effects of potential Board of Health and Environmental Sciences (BHES) decisions regarding the affect of the mine plan on water quality. The Decision Notice will outline the decision to implement specific actions affecting the plan of operations and state permit. Although effects of other potential activities within the Stillwater Complex are included in this analysis, the Forest Service's decision document resulting from this environmental analysis will make a decision only on the proposed expansion.

The Commissioner of State Lands and the Forest Supervisor of the Custer National Forest are the officials responsible for approving SMC's proposal to expand its existing operation in the Stillwater Complex. The BHES is responsible for approving any change in water quality as requested by SMC in its "Petition for Modification of Quality of Ambient Waters" (SMC, 1991a).

1.4 Land Status

The proposed mine development is located along the east and west banks of the Stillwater River approximately 5 miles southwest of Nye, Montana, (Figure 1.1-1) and encompasses approximately 1,233 acres within the permit boundary. Land ownership in the permit area is composed of federal and private holdings. SMC privately controls 332 acres in the existing permit area, 775 acres are owned by the United States of America and managed by the U.S. Forest Service, and 126 acres are privately owned by the Mouat Estate.

SMC through Manville has made application to patent 209 additional acres within the current permit boundary. The application is currently being reviewed by the U.S. Forest Service in

cooperation with the U.S. Bureau of Land Management.

1.5 Agency Roles and Responsibilities

On December 11, 1989, the State of Montana, Department of State Lands and the U.S. Department of Agriculture, Forest Service entered into a Memorandum of Understanding (MOU) to promote efficiency and effectiveness in their administration and regulation of locatable mineral activities under their respective authorities and responsibilities. This MOU provided for the preparation of joint environmental analyses, sharing of information, personnel, and funds. It is the policy of both agencies to prepare such environmental analyses that will meet the requirements of both National Environmental Policy Act (NEPA) and Montana Environmental Policy Act (MEPA) and other applicable State and Federal laws and regulations.

1.5.1 Department of State Lands

The Commissioner of State Lands must decide whether to approve the project as applied for, approve alternative plans, approve subject to modification through stipulations, or deny the permit as required by the Montana Metal Mine Reclamation Act (MMRA)(Title 82, Chapter 4, Part 3, MCA).

The DSL administers the MMRA which applies to all state, federal and private lands. The purpose of the act is to provide that the usefulness, productivity, and scenic values of all lands and surface waters involved in mining and exploration receive the greatest reasonable degree of protection and are reclaimed to beneficial use. The act and its regulations (ARM 26.4.101 et seq.) set forth the steps to be taken in the issuance of an operating permit for and the reclamation of the applicant's proposed mine expansion. The act applies to private, federal and state lands within Montana.

DSL's rules (ARM 26.2.601 et seq.) implementing MEPA (Title 75, Chapter 1, MCA) also require preparation of an environmental analysis. The Department has determined that an Environmental Impact Statement (EIS) is appropriate for this project. This EIS has several purposes:

a. It serves to ensure that the agency uses the natural and social sciences and the environmental design arts in planning and decision-making;

b. It assists in the evaluation of reasonable alternatives and the development of conditions, stipulations or modifications to be made part of a proposed action;

c. It ensures the fullest appropriate opportunity for public review and comment on proposed actions, including alternatives and planned mitigation; and

d. It examines and documents the effects of a proposed action on the quality of the human environment, and provides the basis for public review and comment.

The Commissioner may deny a permit when it can be demonstrated that air and water statutes cannot be complied with and/or the reclamation plan as proposed is not feasible (82-4-351, MCA). A permit may also be denied if a person, or any firm or business association of which that person was a

principal or controlling member has a bond forfeited (82-4-360, MCA) or for failure to reclaim an operation (82-4-341(6), MCA). SMC has not forfeited any bonds under the MMRA and has not failed in its reclamation obligations.

Reclamation bonding is also determined by DSL under MMRA. Reclamation bonds are determined by computing costs to the State of reclaiming a site should the operator default. After an application has been approved and mitigation measures are stipulated, the bond is calculated based on the approved and permitted specifications. The bond will include long-term maintenance of water treatment facilities such as percolation ponds and diversion ditches, demolition of buildings and other facilities, earth movement and soil replacement, seedbed preparation and revegetation.

In addition, if the Forest Service should deem the State's bond insufficient, the Forest Service could require its own bond. SMC's present bond is $1,477,000.00.

1.5.2 U.S. Forest Service

The Forest Service has authority for regulating all activities and uses of National Forest system lands. The Forest Supervisor can decide to approve the amendment to the plan of operations as submitted, approve the amendment to the plan with modifications or mitigation measures, or notify SMC that the amendment can not be approved until an environmental impact statement has been prepared (36 CFR 228).

The 1872 General Mining Law, as amended, grants all US citizens the right to locate and develop a mining claim on national forest system lands open to mineral entry. At the same time, the Organic Administration Act of 1897 authorizes the Secretary of Agriculture to regulate occupancy and use of the national forest resources. The regulations (36 CFR 228) pertain to all National Forest users who operate under the mining laws. The Forest Service retains the right to manage and dispose of surface resources on unpatented mining claims to the extent that this does not unreasonably interfere with mining activity.

The U.S. Forest Service management policy for mining activity originates from the 1872 General Mining Law, as amended, the Mining and Mineral Policy Act of 1970, the National Materials and Minerals Policy, Research and Development Act of 1980, and a number of executive orders. It is National Forest Service policy to encourage the exploration, development, and production of mineral resources on all lands open to mineral entry.

The area involved in this proposal is within Management Area E as described in the Custer National Forest Land and Resource Management Plan (1986). The management goal for Management Area E is as follows:

> To facilitate and encourage the exploration, development, and production of energy and mineral resources from the National Forest System lands. Other resources will be considered and impacts will be mitigated to the extent possible through standard operating procedures, and, on a limited basis, through special lease stipulations necessary to manage key surface resources. Energy/mineral development will not be

precluded by these resource concerns within legal constraints. Efforts will be made to avoid or mitigate resource conflicts. If the responsible official determines that conflicts cannot be adequately mitigated she/he will resolve the conflict in accordance with the management goal and, if necessary, in consultation with affected parties. (Forest Plan, page 58).

1.5.3 Other Federal Agencies

U.S. Fish and Wildlife Service

The U.S. Fish and Wildlife Service (USFWS) administers the Endangered Species Act (ESA) and the Bald Eagle Protection Act. To comply with the ESA the CNF must prepare a Biological Evaluation to determine impacts, if any, which would adversely affect threatened and endangered species. If it is determined adverse effects may occur, the CNF would consult with the USFWS to design measures to protect the affected species.

A Biological Assessment for threatened, endangered and sensitive species is included in this document as an appendix.

1.5.4 Other State Agencies

Department of Health and Environmental Sciences, Air Quality Bureau

The Air Quality Bureau of DHES administers the Clean Air Act of Montana (Title 75, Chapter 2 MCA). Any proposed project with potential to emit more than 25 tpy of any pollutant must obtain an air quality permit prior to construction. The applicant must apply Best Available Control Technology to each emission source. The applicant must also demonstrate that the project will not violate Montana or Federal Ambient Air Quality Standards. SMC already has an Air Quality Permit, No. 2-459A for its current operations. A permit alteration is being reviewed relative to this proposal.

Department of Health and Environmental Sciences, Water Quality Bureau

The Water Quality Bureau (WQB) is responsible for administration of several state statutes including the Public Water Supply Act (Title 75, Chapter 6 MCA), Sanitation and Subdivisions Act (Title 76, Chapter 4 MCA) and the Water Quality Act (Title 75, Chapter 5 MCA). The WQB also administers several sections of the federal Clean Water Act pursuant to the Montana - Environmental Protection Agency (EPA) Agreement. The State of Montana, through the WQB, has been delegated authority for administration of the Nonpoint Source Pollution program (319), National Pollution Discharge Elimination System (NPDES), and Water Quality Standards (CWA section 307).

The Water Quality Act (WQA) provides a regulatory framework for protecting, maintaining and improving the quality of water for beneficial uses. Pursuant to the WQA, the WQB has developed water quality classifications and standards, and a permit system to control discharges into state water. Mining operations must comply with Montana surface and groundwater regulations and standards. SMC currently holds a Montana Pollution Discharge Elimination System (MPDES) permit

(MT-0024716) for discharge of excess adit water into the Stillwater River. This permit expired on March 31, 1991 but has been extended by the WQB pending action by the BHES on SMC's nondegradation petition.

Board of Health and Environmental Sciences

Montana's Nondegradation Policy (75-5-303, MCA) requires that the existing water quality of high quality state water be maintained. Under the State Water Quality Act (WQA), the Board of Health and Environmental Sciences (BHES) may allow degradation of state waters only after treatment of wastes; a demonstration of economic or social necessity; and, a demonstration that any change in quality will not preclude present and anticipated beneficial uses.

During the agencies' review of SMC's Amended Plan of Operations, the WQB determined that the expansion would constitute an enlarged source of pollution and, therefore, would be subject to Montana's nondegradation rules (ARM 16.20.701 et seq.). Subsequently, SMC submitted a Petition for Modification of Quality of Ambient Water (SMC, 1991a) to the BHES on August 19, 1991. The WQB determined the application complete on August 20, 1991, and the BHES decided at its March 20, 1992 meeting to participate in the ongoing USFS-DSL Environmental Impact Statement.

This EIS includes an analysis of the petition. Following preparation of the Final EIS the BHES will hold a formal public hearing on the petition. A decision to grant or deny the petition can either be made at that time, or, no later than the BHES's next regularly scheduled meeting. All persons who are on the USFS-DSL EIS mailing list will receive notice of BHES's hearing. Following BHES action a statement of reasons for granting or denying the petition will be issued.

Department of Commerce, Hard Rock Mining Impact Board

The Hard Rock Mining Impact Board, created by the passage of the Hard Rock Impact Act (Title 90, Chapter 6, Part 3, MCA) is attached to the Montana Department of Commerce for administrative purposes. A quasi-judicial board, it is intended to act as a referee in hearing disputes between local government and large-scale mineral developers over the impact mitigation plan. The impact mitigation plan identifies the increased public-sector costs associated with the mineral development and commits to pay, according to a specified time schedule, all increased capital and net operating cost to local government resulting from development. The projected workforce of 525 is 65 higher than the presently approved 460 employees. Therefore, development of the 2000 tpd proposal will not trigger the Hard Rock Impact Act because the projected employment levels are within the accepted variance (15 percent) of the Plan currently in place (SMC, Stillwater County, 1988).

State Historic Preservation Office (SHPO)

The SHPO has the responsibility of cooperating with and advising DSL and the FS when potentially valuable historical, archeological, or other cultural resources are located within a project area (Montana Antiquities Act MCA 22-3-401 through 22-3-442 and the National Historical Preservation Act PL 89-665 as amended and reauthorized E.O. 11593). Advice given may include comments on an applicant's plan for impact mitigation of sites eligible for nomination to the National

Register of Historic Places. The office also reviews the environmental document to ensure compliance with cultural resource regulations. During mine operation, DSL and FS are responsible for monitoring compliance with cultural resource laws and monitoring plans.

Department of Natural Resources and Conservation (DNRC)

DNRC administers two acts that are applicable to mining development. These are The Montana Major Facility Siting Act (Title 75, Chapter 2, MCA) and the Montana Water Use Act (Title 85, Chapter 2 MCA). Any electrical transmission line that exceeds 69 Kv or 10 miles in length requires state approval. A water rights permit is required for any surface water diversion or groundwater withdrawal exceeding 35 gallons per minute or 10 acre feet per year. No new power lines were proposed; no additional water rights need to be implemented.

1.6 The NEPA/MEPA Process

The National Environmental Policy Act (NEPA) and the Montana Environmental Policy Act (MEPA) are Federal and State laws which direct the Forest Service, the DSL and DHES to disclose effects of proposed activities on Federal and State lands to the public and officials making decisions concerning the proposal.

The NEPA/MEPA process began when SMC proposed to amend its current mining plan of operations. The agencies sought public input to help identify environmental issues and concerns through the process called "scoping." Scoping activities for this project included: mailing a scoping document to interested persons; receipt of questionnaire responses and letters; and holding a public meeting in Absarokee, Montana, June 4, 1991. Numerous newspaper articles were published in the local Stillwater and Carbon County papers.

The agencies then prepared and released a draft EA which was mailed to approximately 300 persons on the mailing list. During the 30-day public comment period the agencies received 38 letters. A public hearing held to gather substantive comments was attended by about 100 persons with 10 speakers giving testimony. Substantive comments have been either incorporated into this text, or have been responded to and appear as an appendix to this EIS.

In addition to public scoping the agencies reviewed the proposal for "completeness" to ensure adequate information was contained in the proposal to complete the agencies' environmental analysis. During this phase of scoping the Water Quality Bureau determined that SMC's proposed actions constituted a new and enlarged discharge source and were subject to nondegradation standards. SMC then submitted a petition to amend ambient standards. The environmental analysis phase of the NEPA/MEPA process began after the proposal was declared "complete".

Under NEPA and MEPA, issues and alternatives are developed based on both public and agency input gathered during scoping. These issues are then tracked through the environmental analysis phase of the document.

The deciding officials review the alternatives and weigh the opportunities, tradeoffs, positive and negative impacts, and come to a decision. The decision document outlines the major points of the decision and the rationale used to reach the decision. The activities outlined in the decision document are then approved to be implemented on the ground. All Forest Service decisions concerning mining plans of operations can be appealed under Federal appeal regulations (CFR 217 and 251). State decisions can be challenged in district court.

1.7 Significance

Both NEPA and MEPA provide for writing two environmental documents--environmental assessments (EA) or environmental impact statements (EIS). The laws and rules do not differentiate between EAs and EISs as to the level or quality of analysis. The difference between the two documents is based solely on one fact: that an EIS is required if the decision, in the opinion of the decisionmaker, has or may have legally significant impacts, and an EA is appropriate if the decision does not. An EA's decision document must include one of two statements: either that the impacts are or could be significant, and therefore, an EIS is necessary; or that there is a "finding of no significant impacts (FONSI)." If a FONSI is issued the rationale must be included.

The decisionmaker(s) using analysis in the Draft EA released on December 10, 1991 and guidance in NEPA CEQ regulations (40CFR1508.27) and/or MEPA rules (ARM 26.2.644), have decided that an EIS is the appropriate environmental document.

1.8 Issues

This section of the document discloses environmental and social issues raised during the scoping process. Issues are unresolved conflicts. Some issues fall outside the scope of analysis, such as length of the permitting process and drug education. Other issues are related to specifics of the application and its possible effects. These issues were identified by the agencies and were collated into the following list:

1. Tailing Impoundment Stability/Engineering - There were concerns about the ability of the structure to resist failure from its own weight and by the increased stresses from earthquakes. Would steepening the slope from 2h:1v to 1.6h:1v mean stability must be reevaluated, because catastrophic failure would affect surrounding terrestrial and aquatic ecosystems, and might be a threat to human safety?

2. Tailing Impoundment Reclamation/Revegetation - Concerns were raised about the existing tailing embankment reclamation plan as well as the proposed plan. Existing plan concerns dealt with long term soil erosion effects on tailing embankment revegetation success because of the long length of the 2h:1v slopes. What effects would rock armored 1.6h:1v slopes would have on visual quality and potential forage for wildlife?

   Concerns were also raised about the tailing impoundment surface reclamation plan. The proposed plan would increase the height of the embankment and the depth of

tailing. Would this complicate reclamation, particularly in view of the limited amount of salvaged soil and available waste rock for capping the impoundment surface?

3. Aesthetics - Aesthetics of the tailing impoundment, mill and mining were of concern. Evaluate visual impact of rock armorment vs vegetation. Identify an area of influence and key viewing points. Evaluate positive visual impacts resulting from SMC's operation. Previous operations left chrome stockpiles, trash, an old mill site and paved lot. Would increased production result in increased noise?

4. Socio-Economics - Many concerns were about socio-economics. Increased revenues to the county from mine taxes were supposed to provide relief from increasing property taxes for area residents. Property taxes have increased. Is the mine responsible directly or indirectly for these increases? Evaluate the expansion's impact on local property taxes and the county's tax base. Evaluate the county's ability to provide services with the proposed expansion. Likewise, evaluate impact to area residents if the expansion is not permitted. Should increased employment levels at the mine be addressed in the Hard Rock Impact Plan even though employment may stay below a 15 percent increase?

   Other concerns were about traffic. Would increased traffic mean greater impact to residents along the access routes? Employees may have a right to drive these roads. Legality of the mitigation requiring 3 passengers per vehicle is in question and this should be resolved. Safety needs to be increased before FAS 419 is resurfaced.

5. Wildlife - Concerns were raised about impacts to fish and wildlife due to impoundment construction, mine waste water discharge, or increased sewage disposal. Is wildlife displacement expected? Does elimination of the toe dike area of grass impact the local bighorn sheep herd? Mitigation measures related to bighorn sheep have been in place since mining operation started. It seems the sheep population has not benefitted. Why continue these measures? It appears adverse impacts to wildlife have not occurred due to mining in the area. Evaluate all the sources of bighorn mortality such as mountain lions, eagles, diseases, and mining.

6. Water Resources - Concerns were that the proposal may make changes in water quality and quantity for groundwater and surface water, and the changes may not comply with Montana's nondegradation law.

7. Wetlands/Flood Plain - The possible loss of wetlands was of concern.

8. Cumulative Effects/Greater Yellowstone Area - Concern was expressed about the cumulative impacts to the Greater Yellowstone Area.

9. Soil Salvage - Concerns were raised about soil salvage to date and the effect on reclamation feasibility for all SMC disturbances.

1.9 Issue Statements

This section is not a summary of impacts. Issue statements briefly summarize portions of the proposal over which concerns have been raised, and then link those portions to the substantive issues raised during scoping. Issue statements focus and help define the range of the analysis.

1.9.1 Tailing Impoundment

Proposal

SMC proposes to amend the current plans for construction and reclamation of the tailing impoundment. These modifications are designed to increase the storage capacity required to accommodate doubling ore production and increase the life of the tailing impoundment. Specific modifications include 1) increasing the height of the impoundment, 2) steepening the impoundment side slopes, and 3) covering impoundment side slopes with large rocks. The increased depth of the tailing would increase the potential settlement of tailing mass. Presently, the tailing impoundment elevation is approved at elevation 5,111 feet during final reclamation. SMC proposes to increase the final reclamation elevation to 5,128 feet.

In accordance with current stipulations, all tailing impoundment side slopes have been constructed at a 2h:1v slope. The submitted amendment proposes to increase the exterior slope steepness to 1.6h:1v, thereby increasing the storage capacity of the tailing facility. The current final reclamation plan calls for 100 percent vegetative cover on impoundment slopes. Increasing slope steepness may make the establishment of vegetation difficult during final reclamation. SMC proposes to replace final reclamation vegetation with the placement of large rocks on the slope surface.

Issues Raised

Many persons voiced concerns that these changes may result in varying degrees of impacts to area resources. Recreationists and local residents may be aesthetically impacted due to an increase in tailing impoundment height, increased steepness of impoundment slopes, replacement of vegetation with large rocks at the final reclamation stage, the creation of additional noise, and fugitive dust during construction of mining support facilities. These impacts would be most noticeable during the peak visitor use period which occurs between June 1 and September 15 annually. However, some degree of impacts would occur throughout the year, mainly to people residing in the project area. For analysis of the aesthetics issue and to see if these impacts would occur, see section 4.7.

Other concerns were that the increased impoundment height in conjunction with increased slope steepness may render the impoundment facility more susceptible to failure from both internal and external forces by reducing the factor of safety to minimum engineering standards. The tailing impoundment lies in a region that is still geologically active as evidenced by earthquakes and fault movement in the area. A failure of the tailing impoundment also could have serious consequences for the Stillwater River and those creatures which utilize the river. Presently, the Stillwater River provides quality spawning habitat for trout species. The addition of tailing slimes to these spawning areas

could impact the existing coldwater fisheries For analysis of stability, and to see if these impact would occur, see Section 4.1.

Increased impoundment height could slow down the reclamation process and increase the likelihood that final reclamation gradients could not be maintained. Limited waste rock and soil are presently available for capping the tailing. For analysis of reclamation, and to see if these impacts would occur, see Section 4.3.

The agencies raised concerns about the amount of soil salvaged to date, soil losses from erosion and potential soil losses from piping into subsurface embankment construction materials on the currently permitted vegetated 2h:1v tailing embankment face make reclamation success questionable. Large pre-existing disturbances and boulders on the surface of undisturbed soils have limited soil salvage to date. Increased awareness of the value of marginal soils for reclamation have changed the agencies' soil salvage standards since the SMC operating permit was issued in 1985. The agencies believe that the presently approved reclamation plan for all mine disturbances should be reevaluated to address "comparable stability and utility" as required by the Metal Mine Reclamation Act and SMC's long-term reclamation objective of "re-establishment of post-operational biological potential suitable for supporting vegetation cover and wildlife habitat appropriate to the area". For analysis of this reclamation issue, and to see if these impacts would occur, see Section 4.3.

Also of concern was the impacts of rock armor. Rock armor on a 1.6h:1v proposed embankment face limits soil use and subsequent soil loss, but has potential visual impacts as well as eliminating potential forage for wildlife. For analysis of the aesthetics, and to see if these impacts would occur, see section 4.7. For analysis of wildlife, and to see if these impacts would occur, see section 4.4.

1.9.2 Socio-Economics/Traffic

Proposal

Presently SMC employs approximately 364 persons at the mine site south of Nye, Montana. Under the proposed amendment, the level of employment would be incrementally increased to 525 full-time employees. The majority of SMC personnel live either in Stillwater or Carbon counties. These people reach the mine site via major county roads.

Issues Raised

Concerns were raised that as employment levels at the mine increase, the projected volume of commuter traffic will likewise increase. County residents who live along access routes may have their quality of life effected by this traffic. The safety of local residents along these access routes and within small towns has been identified as a concern. For analysis of traffic impacts and to see if these impacts would occur, see Section 4.8.

Other economic concerns that increased population levels may place pressures on the abilities of Stillwater and Carbon counties to supply goods and services to all county residents. Real property

values of persons living in the Stillwater Valley could be effected by expansion of the mine complex. Additionally, capital investments required for increased production might directly influence incoming revenues to Stillwater County. For analysis of socio-economics issues, and to see if these impacts would occur, see Section 4.8.

Increased mine activity may influence traffic volumes in the vicinity of Woodbine campground and trailhead, and the Horseman Flats area. For analysis of recreation, see Section 4.6. Recreation use patterns may change as a result of this increased traffic on the project area.

1.9.3 Wildlife

Proposal

SMC proposes to replace the grass vegetation on the tailing embankment with rock armor, eliminating about 42 acres of vegetative habitat.

Issues Raised

The area around the Stillwater mine currently provides critical winter range for bighorn sheep. Recently the herd has experienced major population declines. Additional impacts to this herd may take place due to an increase in mine-related traffic or the proposed tailing impoundment modifications. These tailing facility modifications would eliminate current forage or future forage from use by the bighorn sheep herd.

Also, elk have historically used the grass/forb vegetation communities which lie in the vicinity of the mine complex, and concern has been raised related to the effects of increased mining to this species. For analysis of wildlife impacts which would occur, see Section 4.4.

1.9.4 Surface and Groundwater Resources

Proposal

Doubling production at the mine would not require approval of new adit development. Adits which have been approved would be used for access to increase ore production. However, doubling production would require additional underground blasting in order to free the ore which will be removed for milling.

Issues Raised

Concerns were raised that as a result of increased underground blasting, aquifers may be altered in terms of flow patterns or chemical composition. If these bedrock aquifers are altered, springs or creeks may dry up or be rendered unusable for human or wildlife use. The greatest impact would take place during the time of year when surface flows are typically low (September to April). For analysis of water resources impacts which would occur, see section 4.2.

1.9.5 Wetlands/Flood Plains

Proposal

Currently, the tailings impoundment facility does not encroach upon the Stillwater River 100-year flood plain. The agencies developed modifications to the tailing facility's engineering design (Alternative 3d) to extending the toe slope towards the Stillwater River.

Issues Raised

Concern was raised that extending the dam eastward may effect either the flood plain or associated wetlands in the area and could potentially eliminate habitat for wildlife species which depend on wetlands or flood plain vegetation communities.

Note: No wetlands or 100-year floodplains are affected by the alternative, so this issue has not been carried forward.

CHAPTER 2 - SUMMARY OF PROPOSALS, ALTERNATIVES, AND OTHER DEVELOPMENTS

2.0 Introduction

This chapter summarizes the proposed action submitted by SMC and alternatives to the proposed action, including a no-action alternative (Alternative 1). The first subsection of this chapter, Development of Alternatives (2.1), describes how the alternatives analyzed in this environmental impact statement were developed. The next subsection (2.2), describes the no-action alternative (Alternative 1) whereby the permit for increased production would not be approved. The no-action alternative would represent the continuation of current mining activity at the Nye facility. Subsection 2.3 briefly summarizes the proposed action (Alternative 2) as submitted by SMC. The reader is encouraged to read the application for complete information. Modifications to the proposed action which are presented in subsection 2.4 explore changes in the tailing impoundment (Alternative 3a, b, c and d) and mine water treatments (Alternative 4a, b, and c). Mitigation measures developed to minimize or alleviate environmental or socio-economic impacts due to implementation of the proposed action are described in subsection 2.5 (Alternative 5). Finally, subsection 2.6 describes other potential development activities which are reasonably foreseeable on the CNF or the GNF within the project area.

A summary of the alternatives and their potential impacts is displayed in Table 2.0-1 located at the end of this chapter.

2.1 Development of Alternatives

Consideration and evaluation of a full range of alternatives is required by both the MEPA and the NEPA. The reason for this policy is that identification of alternatives may minimize or even eliminate these impacts of the proposed action. In addition, Montana's nondegradation rules require that a petition be submitted to the BHES for amendment of ambient (existing) water quality contain alternatives to the proposed effluent levels which would result in no, or less, degradation, of state water [ARM 16.20.704 (3)(e)]. SMC has considered three treatment alternatives in fulfillment of this requirement (SMC, 1991a). Those alternatives are presented and analyzed in this document.

Alternatives have been identified and refined by three basic methods. First, the interdisciplinary team comprised of DSL, WQB and FS resource specialists internally identified alternatives to the proposed action. This tentative list of alternatives appeared on page 2 of the scoping document. The scoping document was mailed to groups or individuals which had previously expressed interest in similar projects.

Second, DSL and the FS held a public meeting in Absarokee, Montana, on June 4, 1991. This step initiated the "scoping" effort for the project. The intent of this meeting was to solicit input in order to develop additional alternatives and to ensure that public issues and concerns were identified. Project scoping suggested that concerns related to the proposed action focused on possible modifications to the tailing impoundment and water quality and quantity.

Finally, the interdisciplinary team reviewed the tentatively identified alternatives in light of public concern expressed during the scoping period. This exercise has resulted in the final range of alternatives which will be evaluated in this EIS.

2.2 Alternative 1 - No Action

The no-action alternative is evaluated in order to establish a baseline condition of existing and future environmental conditions in and around the project area as required by the Council on Environmental Quality (CEQ) guidelines. Under this alternative, SMC would not receive a permit to increase ore production to 2,000 tpd. Mining would continue under the current approved plan of operations rate of 1,000 tpd, and all existing support facilities, personnel requirements and reclamation stipulations would continue unchanged. Specific details related to the current level of ore production may be found within the 1989 EA/PER for the East Side Amendment. This baseline condition is described in Chapter 3 (Affected Environment).

Under this alternative no "new or enlarged source of pollution" would exist and the nondegradation rules would not apply to SMC operations. The MPDES permit would be renewed with the existing discharge effluent limits, and the current practice of land application would be maintained. Under the existing MPDES permit SMC has been granted a mixing zone for groundwater within the property boundary. Under groundwater rules, standards may be exceeded in mixing zones (ARM 16.20.1010).

2.3 Alternative 2 - Company's Proposal

The following description of the proposed action is largely based on SMC's application to amend the approved plan of operations, Permit No. 00118. Additional information has been added where clarification is needed; however, the following summary is quite succinct compared to the level of detail contained in the proposed application. Figure 2.3-1 is a map of the proposed facilities. For the complete project description as proposed by SMC, the reader is referred to the application for Amendment to Permit No. 00118 (SMC, December 1990), called the Mine Expansion - 2,000-tpd application. This application is available for public review at Beartooth Ranger District, Supervisor's Office of the Custer National Forest, and Department of State Lands' Helena office.

2.3.1 Mining Plans and Methods

The principal mining method, cut-and-fill stoping, utilized for this amendment would be the same as currently used at the Stillwater Mine. A detailed description of this technique may be found in the 1985 Environmental Impact Statement (EIS) for the Stillwater Project on pages II-6 to II-11 (DSL/FS, 1985). SMC's current permit provides for eleven adits and one shaft on the west side of the Stillwater River, and six adits and one shaft on the east side. These openings would be used in developing the ore body, and would be constructed as development occurs over the life of the operation. No additional surface openings are proposed as part of this amendment.

Ore grade is variable throughout the ore zone, which requires that the zone be mined selectively rather than continuously. The ore body is accessed by a crosscut, a raise is driven up into

RANGE 15 EAST

TOWNSHIP 5 SOUTH

510,000 N

508,000 N

506,000 N

504,000 N

1,896,000 E

1,898,000 E

1,900,000 E

1,902,000 E

1,904,000 E

1,906,000 E

1,908,000 E

Operating Permit Boundary

6900 Portal (Unconstructed)

Mountoin View Townsite

Mountoin View Mine

Mountain View Lake

6500 Portal

6300 Portal (Unconstructed)

6100 Portal (Unconstructed)

5900 Portal

5900 Laydown Area/Waste Dump

5700 Portal

5500 Portal

5300 Portal

Topsoil Stockpile

Proposed Permanent Waste Rock Storage/ Laydown Area

Proposed Laydown Area

Temporary Waste Rock Storage /Laydown Area

Soil Stockpile A

Proposed Drainfield Extension

Proposed Parking Lot Extension

Proposed Temporary Waste Rock Storage

MPC Substation

Proposed Mill Building Extension

Proposed Conveyor Stacker

5000 Portal (2 Adits)

Mill Building

5150 Portal

Laydown Area

Ore Dump Packet

Runoff Diversion Berm

Relocated Warehouse/ Truckshop

Mine Water Emergency Overflow Pond

West Emergency Spill Basin

Thickener

Soil Stockpile C

Sed/Perc Ponds (3)

Core Storage

Administration Building

Potable Well

Upwind Air Quality Stotion

Relocated Guard Shack

Downwind Air Quality Station

East Emergency Spill Basin

Proposed Permanent Waste Rock Berm For Visual Screening

Proposed Laydown Area

Thickener

Ore Dump Packet

5000 Portal

Proposed Droinfield

Sed/Perc Ponds (5)

Proposed Building

Proposed Parking

Potable Well

5200 Portal (Unconstructed)

5400 Portal (Unconstructed)

Pumphouse

Soil Stockpile B

Topsoil Stockpile

Percolation Ponds (4)

Topsoil Stockpiles

Currently Permitted (Not Constructed) E. Side Shaft Site

5600 Portal (Unconstructed)

Surface Vent Raise

5800 Portal (Unconstructed)

6000 Portal (Unconstructed)

Legend

- Relocated Facilities
- Proposed New Facilities
- Existing
- Currently Permitted, But Not Constructed Portals
- Existing Roads
- Permitted/Not Constructed Access Roads
- Above Ground Pipelines
- Powerline Corridor

SCALE IN FEET

0 500 1000

Stillwater Mining Company

Facilities Locotion Map

Existing and Propased Facilities for Amendment #8

5/8/91

Figure 2.3-1

the ore body for stoping. This raise contains an orechute, a manway for personnel access, and a timberslide compartment for materials and supplies transportation. Stopes extend between levels (approximately 200 feet in height), and average approximately 200 feet in length. The stopes are mined from the bottom to the top, taking a series of approximately 8-foot high horizontal cuts. An orechute transfers ore from the stope to the main haulage level below. After each cut is mined, the resultant opening is filled with classified mill tailings or ground and sized sandfill. The sandfill is used to provide a working surface from which the next cut would be mined. A more detailed discussion of mining methods currently used at SMC is contained in the 1988 East Side Expansion Amendment (DSL/USFS, 1988). Use of other mining techniques, such as shrinkage stoping and modified sublevel stoping, may be employed in the future in the areas of the mine where conditions permit.

2.3.2 Explosives

Blasting is conducted as an integral part of the mining operations. The types of explosive presently being used are low-solubility, water gel and emulsified explosives.

2.3.3 Production

The SMC operation consists of an underground platinum/palladium mine with a nominal production rate averaging 365,000 tpy, or 1,000 tpd of ore. The current amendment proposes to double ore production in order to reach a nominal production rate of 730,000 tpy or 2,000 tpd. This proposed amendment is based upon an operational mine life of 18 to 20 years. The actual life of the operation, however, would be determined by the economical viability of the operation. Project viability is a function of metal prices, ore grade, continuity of the ore zone, and cost of production.

2.3.4 Ore Processing

The ore is upgraded on site in the mill by crushing, grinding, flotation, and drying to obtain a dried concentrate. This concentrate is shipped by truck from the Nye operation to SMC's smelter in Columbus, Montana, for further processing to a matte stage. The smelter matte is subsequently shipped to Belgium for refining. Expansion of the mill grinding, flotation, and tailing disposal systems are proposed via this amendment. The additional equipment required to support a production rate of 2,000 tpd would be installed within the present mill building in the area directly adjacent to existing ore processing circuit.

Additional details related to ore processing may be found in the 1985 EIS and within Operating Permit No. 00118.

2.3.5 Tailing Disposal Facility - Impoundment

SMC proposes to modify the current tailing impoundment specifications. Presently, Operating Permit No. 00118 stipulates that the tailing impoundment embankment slopes will be constructed at a 2h:1v. The storage volume of the impoundment would be increased by changing the slope of the downstream embankment from 2h:1v to 1.6h:1v. The inside slope would remain at 2h:1v. At the proposed increased capacity, the tailing pond surface area would be approximately 52 acres, tailing

storage would be approximately 5.0 million tons, and maximum dam height would be approximately 155 feet above ground-level topography. An additional 15 feet would be added to the currently permitted dam height with a 3-foot berm constructed on the crest, for freeboard purposes. The final elevation of the dam would be 5,125 feet plus 3-foot freeboard. Currently, the approved final tailing impoundment elevation is 5,111 feet.

2.3.6 Waste Rock

Waste rock is hauled by rail or mobile haulage equipment and dumped into waste/ore passes that extend from the upper levels of the mine to the main haulage levels. This material is then transported out of the mine by rail haulage-systems or rubber-tired trucks where rail systems have not been installed. West-side waste rock is trucked to the tailing impoundment or other locations as needed. Most east-side waste is hauled to the west side for incorporation into the tailing impoundment facility. In addition to the use of waste rock material for construction of the tailing facility, this material may be utilized for 1) road surfacing material, 2) portal yard construction, 3) backfill of underground stopes as they are mined, 4) construction of berms for safety and visual screening purposes, percolation ponds and the tailing impoundment, and 5) use as reclamation materials such as cover soils, subsoils or rock armor.

2.3.7 Mine Water Use and Management

All water used on site comes from one of three sources: potable wells, the Stillwater River, and appropriated groundwater encountered during the mining operation (adit water).

2.3.7.1 Potable Water

The existing east- and west-side potable water wells are tied together through a common distribution system to supply the surface support facilities and underground mine workings. Each well has a capacity of 200 gpm, and is demand activated. In order to partially mitigate water quality impacts and reduce water handling cost, SMC is discontinuing the practice of pumping fresh water underground as a source of potable water and drill water. Therefore, no additional potable water wells are proposed as part of this amendment.

2.3.7.2 Stillwater River Water

SMC has water right to use water from the Stillwater River to supplement mill make-up water, if required, through use of a 1,000-gpm electric pump. River water is also used for fire protection, through a dedicated supply system. The fire water system is supplied by a demand-activated diesel pumping system capable of supplying 1,000 gpm. Supplemental use of Stillwater River water is infrequent.

2.3.7.3 Adit Water

Currently, the combined total adit water flow from both the west- and east-side mining activities is made up of approximately 90 gpm from the sandfill process, 120 gpm from mining

sources (i.e. drilling, dust suppression), and approximately 514 gpm from groundwater. This 724 gpm total is referred to as adit water and is currently routed for treatment prior to utilization or disposal. This treatment consists of clarification on both the east and west sides for solids removal. The clarifiers remove fine particulate (slimes) leaving the treated water free for use in the irrigation of reclamation, for soil stabilization, dust control, or for use as mill process make-up water. Excess water is routed to the sedimentation/percolation ponds for disposal.

Periodically, higher flows result from the interception of water which has been stored in faults and fractures. These fractures, faults, and shear zones may be dewatered as mining continues. Consequently, large quantities of adit water may be generated for short periods of time. This water would be used for irrigation through existing mine water systems, diverted to the tailing impoundment for use as mill make-up water, or diverted to percolation ponds and/or the emergency containment basins. In areas where water-bearing structures are intercepted by mine development and no stoping is planned, grouting techniques may be used to slow inflows. In the case of a drill hole, a packer may be installed.

2.3.7.4 Project Water Management

A general project water balance is shown in Figure 2.3-2. Under normal conditions, a water balance is maintained by a closed-loop system. During periods when process water in the tailing pond is excess, the adit water is directed to the clarifiers for cleaning and subsequent disposal, either by irrigation, evaporation, or by percolation.

2.3.8 Energy Consumption and Source

At this time, Montana Power Company (MPC) is capable of providing the project with 8 megawatts of power through the existing power lines. Present maximum demand is 5.8 megawatts. Planned upgrades in power supply lines by MPC could increase capacity to 11 megawatts by the summer of 1992. MPC is replacing the existing line because of deterioration in the 60-year old line, relocation of Highway 78, and increased loads in the Columbus area. MPC's anticipated power demand for mine production at 2,000 tpd is approximately 12 megawatts. Additional improvements planned by MPC which will be completed in 1993 would increase capacity well above SMC's anticipated requirements.

Most electrical power lines serving underground workings would be routed between mine levels through internal drill holes. When feasible, power requirements at portal sites during portal development would be supplied by running a power line through internal boreholes from a lower level. At times, however it may be necessary to temporarily use a standby diesel-powered generator at the development site until internal power line routes can be established. These generators may vary in size from 1.5 to 500 kW.

On rare occasions and for short periods of time, generated power may exceed 1 megawatt in order to maintain mine ventilation systems and critical power during emergencies and planned temporary power outages.

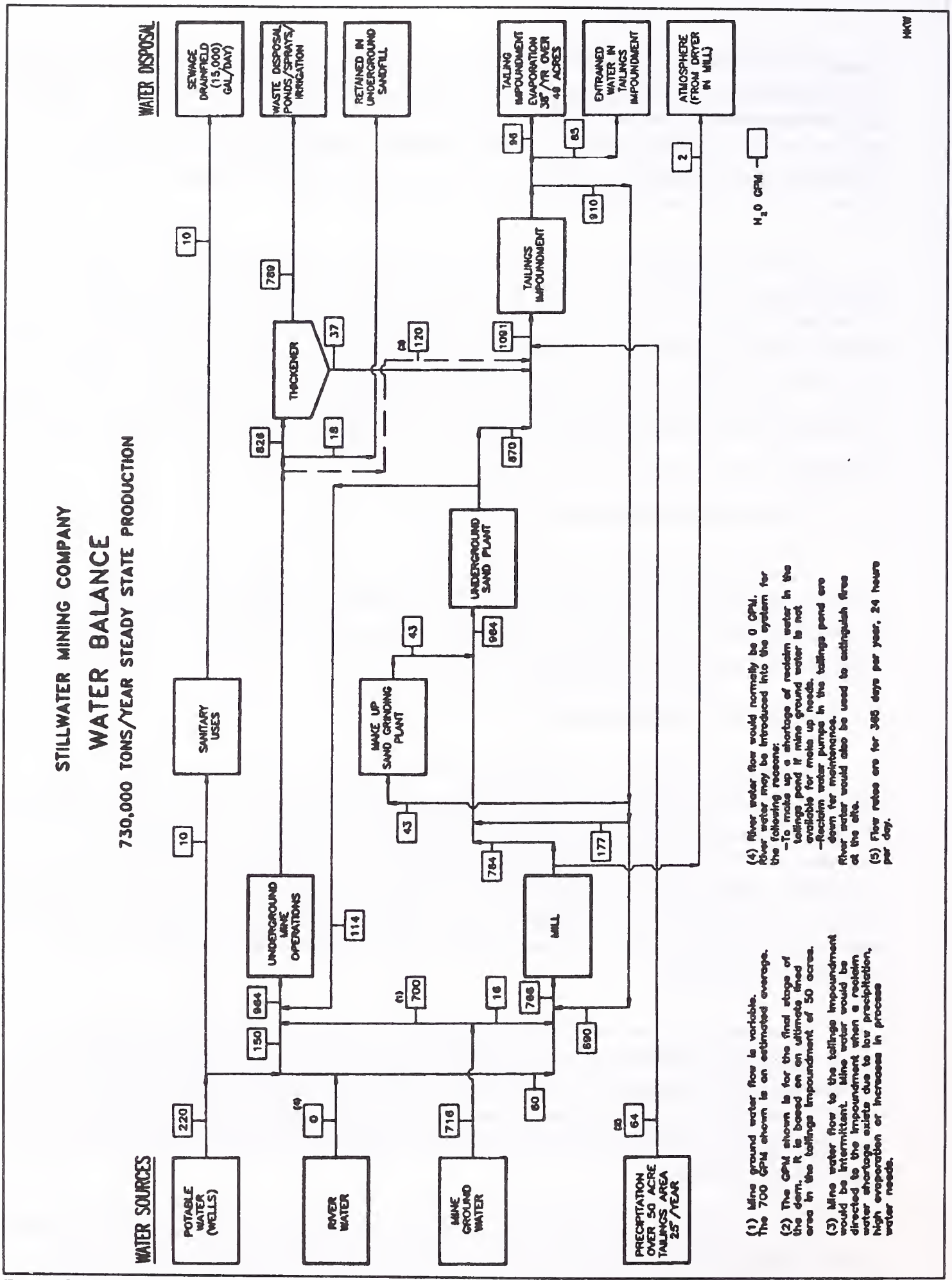
STILLWATER MINING COMPANY
WATER BALANCE
730,000 TONS/YEAR STEADY STATE PRODUCTION
WATER DISPOSAL
SEWAGE DRAINFIELD (15,000) GAL/DAY
WASTE DISPOSAL PONDS/SPRAYS/ IRRIGATION
RETAINED IN UNDERGROUND SANDFILL
TAILING IMPOUNDMENT EVAPORATION 35"/YR OVER 49 ACRES
ENTRAINED WATER IN TAILINGS IMPOUNDMENT
ATMOSPHERE (FROM DRYER IN MILL)
TAILINGS IMPOUNDMENT
THICKENER
UNDERGROUND SAND PLANT
MAKE UP SAND GRINDING PLANT
SANITARY USES
UNDERGROUND MINE OPERATIONS
MILL
WATER SOURCES
POTABLE WATER (WELLS)
RIVER WATER
MINE GROUND WATER
PRECIPITATION OVER 50 ACRE TAILINGS AREA 25"/YEAR
H_2O GPM
(1) Mine ground water flow is variable. The 700 GPM shown is an estimated average.
(2) The GPM shown is for the final stage of the dam. It is based on an ultimate lined area in the tailings impoundment of 50 acres.
(3) Mine water flow to the tailings impoundment would be intermittent. Mine water would be directed to the impoundment when a reclaim water shortage exists due to low precipitation, high evaporation or increases in process water needs.
(4) River water flow would normally be 0 GPM. River water may be introduced into the system for the following reasons:
-To make up a shortage of reclaim water in the tailings pond if mine ground water is not available for make up needs.
-Reclaim water pumps in the tailings pond are down for maintenance.
River water would also be used to extinguish fires at the site.
(5) Flow rates are for 365 days per year, 24 hours per day.

Figure 2.3-2 Water Balance

2.3.9 Roads

No modifications to the permitted transportation system within the permit boundary or to external public transportation systems (FAS 419 or FS 846) are proposed via this amendment. However, the mill complex access may be relocated to the north end of the existing mine water overflow pond (Figure 2.3-1).

2.3.10 Equipment

Equipment at the mine facility consists of locomotives, muck cars, flat cars, jumbos, load, haul, and dump (LHD) vehicles, jacklegs/stopers, underground trucks, diamond drills, raise borers, dump trucks, front-end loaders, flatbed trucks (low boy), pickups, tunnel boring machine, and personnel vans and buses.

2.3.11 Surface Support Facilities

West Side

The existing west-side facilities have been approved via previous amendments. Further detail related to these facilities may be found in either the 1985 EIS or 1989 East Side EA/PER. This discussion deals only with the changes proposed by SMC in this application. For additional facilities location details refer to Figure 2.3-1.

Mill Building

Changes in the size and configuration of the mill building would be needed to accommodate the expansion. The expanded mill facility would occupy the area directly north of the mill in the area occupied by mill maintenance.

Additionally, the employees' change room would be enlarged to accommodate the additional 65 workers. Increased office space for administrative staff may also be necessary.

Parking Lot

An estimated expansion of 100 feet by 200 feet is planned adjacent to the present employee parking lot to replace parking lost to expansion of the mill facility.

Additional Laydown Areas

Additional laydown areas would be needed to handle the storage of bulk mine and mill supplies. Approximately 3 to 5 acres would be required on the west side for this purpose.

Mine Equipment/Truck Shop/Warehouse and Mill Shop Relocation

The warehouse would need additional room to store and control the expanded inventory of supplies and machine parts. Similarly, the current truck shop and mill maintenance shop would be enlarged. To accommodate this growth, a new truck shop, warehouse, and mill shop are being proposed in the area directly adjacent to the existing security office. Additionally, this location could be changed should the ore dump pocket be moved behind the current mill area.

East Side

SMC proposed that the currently permitted (not yet constructed) building near the 5000 East Adit location would be expanded to provide storage and administrative space for the east side operation. This building would be approximately 60 by 300 feet in size and could contain offices, safety and training rooms, a warehouse area, change rooms, and a shop area for locomotive and equipment repairs. A septic and leach field system would be required to service this building. Additionally, a parking area would be required.

Compressors may be housed adjacent to the 5000 East Adit portal structure in a separate enclosure to allow utilization of their waste heat to assist in warming mine ventilation air.

Expansion would require additional storage for bulk supplies and materials. This would occur in the area north of the 5000 East Adit. A berm would be constructed and vegetated around this laydown area in order to minimize visual impacts. This additional laydown/storage area is on previously disturbed ground.

2.3.12 Mine Utilities

Mine utilities consisting of a sand-fill system and mine-ventilation system would not be changed as a result of this proposed amendment. Additional detail may be found in both the original 1985 EIS for the Stillwater Project or 1989 East Side EA/PER.

2.3.13 Security and Public Safety

Security at Stillwater mine is currently provided by SMC employees. At least one security guard is on duty in the security building on all shifts, and security is maintained 24 hours per day.

Access to the east side is secured by a locking barrier across the Stillwater River Bridge on weekends, holidays, or other periods when personnel are not on duty. It may become necessary in the future to add another security building of the east side of the river. Additionally, access roads from FS 846 into SMC's west side operating areas are also secured by means of locking barriers during those same periods. A 6-foot chain link fence surrounds the tailings impoundment and equipment storage areas to prevent unauthorized entry.

The existing guard shack/security office may be moved from its present location to an area below the mill building between the west side septic drainfield and the mine water overflow pond. A new access road off FAS 419 to the parking area would be constructed as part of this move.

2.3.14 Sewage Disposal

The main sewage collection system now serving the project is located near the mill on the west side. Sewage is routed to a treatment (septic) system and leach field, which has the capacity of approximately 13,000 gpd. SMC has evaluated the system and determined the increase in work force and relocation of the administrative group to the mill building would require additional sewage handling capacity. This capacity can be obtained through enlargement of the existing leach field or addition of a second system. Figure 2.3-1 indicates the location of this second system.

There are currently no permanent buildings on the east side. Sewage from the east side operation is contained in portable sanitary facilities, which are pumped every two weeks. Plans for a building which would house a locomotive repair shop, air compressors, change room, warehouse, and mine offices on the east side would require installation of a permanent sewage treatment system. Figure 2.3-1 shows the approximate location of this system on the east side.

2.3.15 Solid Waste

Waste material from the operation is segregated as much as practical for recycling. Steel and wood are separated from conventional waste material. Steel is sold to a recycler. Scrap wood is made available to mine employees for use as firewood, burned, or disposed of by the County Solid Waste District. Other conventional waste from the operation is disposed of through the Stillwater County Solid Waste System. Any waste classified as hazardous would continue to be disposed of in accordance with applicable local, state and federal laws, rules and regulations.

SMC's solid waste disposal practices were evaluated and approved in 1989 during a site inspection by the DHES. The present system of solid waste disposal would continue with increased emphasis on recycling.

2.3.16 Fire Protection

Fire protection is provided in accordance with MSHA and USFS safety requirements. On-site fire protection facilities include a dedicated, demand-activated diesel-driven pumping system which has a capacity of 1,000 gpm at 105 pounds per square inch (psi). This system draws water from the Stillwater River and distributes it to fire hydrants which are located at strategic points around the west side permit area. New facilities on both the west and east sides proposed via this amendment would also be connected to the current fire hydrant system. In addition, dry chemical A, B, and C type extinguishers are located on mobile equipment as well as throughout the mine and mill complex.

The Nye company of the Absarokee Volunteer Fire Department has a 4-wheel drive pump truck which was provided by SMC through a grant under the Amended Hard Rock Mining Economic Impact Plan (SMC, 1988). This vehicle is on call for emergencies county wide.

2.3.17 Personnel

The proposed expansion would increase mine employment from the current level of 365 to approximately 525 workers. Of the increase, approximately 50 percent are expected to be in-migrating. Employment level of 460 persons was evaluated in the East Side Expansion EA (DSL/FS, 1989) and the impacts addressed in the amended hard rock impact plan (SMC/Stillwater County, 1988). The addition of 65 more employees to presently permitted levels would not automatically trigger impact plan renegotiations.

Table 2.3-1 Proposed Personnel Requirements by Shift

Shift	Mine and Maintenance	Mill	Staff	Total
Day	183	9	21	213
Day (12-hour shift)	12	11	3	26
Afternoon	168	5	5	178
Night	75	5	2	82
Night (12-hour shift)	12	11	3	26
TOTAL	450	41	34	525

2.3.18 Project Closure and Reclamation

The stated life of this mining operation would be shortened by about 5 years if this amendment were approved. This figure is dependent on the tailing impoundment capacity. However, the ultimate life of the mine is dictated by metal values, productivity of the operation, and profitability.

The short-term objectives of the reclamation plan are to stabilize disturbed areas through erosion control, minimize visual impacts of operational disturbances, and prevent air and water pollution. This would be accomplished by a number of operational practices and interim revegetation.

The long-term objective of reclamation is to establish a post-operational environment that is compatible with the existing land uses of the area. Of particular importance is returning disturbed areas within the CNF to a state consistent with the long-term goals as stated in the CNF Land and Resource Management Plan.

SMC's reclamation plan is based on analysis of baseline environmental data, review of current reclamation literature, and three years of on-going reclamation efforts. The plan incorporates many of the goals of the CNF management plan, as well as the Metal Mine Reclamation Act. Specific post-operational land use objectives include:

Permanent protection for air, surface water, and groundwater resources;
Protection of public health and safety by removal of potential hazards;
Establishment of a land configuration compatible in the watershed;
Reestablishment of an aesthetic environment allowing for visual quality and recreational opportunity; and

Reestablishment of post-operational biological potential suitable for supporting vegetative cover and wildlife habitat appropriate to the area.

2.3.18.1 Tailings Impoundment

Expansion of the tailing impoundment as proposed would result in a final crest elevation of 5,125 feet (maximum height of the tailing liner), and the impoundment would cover 70 acres. A 3-foot high berm constructed on the crest for freeboard purposes would remain for reclamation, bringing the final maximum elevation to 5,128 feet. The embankment would continue to be constructed in lifts utilizing conventional waste rock and waste rock generated by the Tunnel Boring Machine (TBM).

Tailing reclamation would consist of dewatering, cap and soil placement, and revegetation of the impoundment surface as well as armoring the embankment to provide for stabilization. Resoiling, revegetation, and further specifics of tailing dewatering are discussed in detail in Section 4.1 of the 1988 East Side Expansion Plan of Operations amendment.

2.3.18.2 Grading

After the tailing has been sufficiently dewatered to support construction equipment, the tailing surface would be graded as indicated in Figure 2.3-3 (plan view) and 2.3-4 (cross section). Tailing would be bulldozed to prevent runoff over the embankment face and to account for differential settling. It is estimated that following the 2 years after reclamation, settlements of up to 2 feet could occur near the center of the impoundment where the depth of tailings is the greatest. Smaller amounts of settlement would occur towards the edges of the impoundment. Additional settlement of 3 inches is anticipated during the next 3 years. Regrading would result in some compaction; however, final contour would take into account final settlement so that depressions would not occur.

Grading of tailing or waste rock would be conducted so that a minimum of one percent slope (post-settlement) away from the embankment will be achieved. Surface drainage from the impoundment would be collected by the perimeter drainage ditch and flow around the ends of the impoundment into natural channels. In areas of the impoundment where the tailing may be difficult to dewater, the tailing would be covered with mine waste rock to achieve post-operation design.

The tailing would have a low bearing capacity and it may be necessary to provide subgrade reinforcement. Such reinforcement typically consists of subgrade stabilization fabric which would prevent bearing failure caused by the weight of the mine waste rock and construction equipment. The stabilization fabric would not act as a filter between the two materials to prevent the tailing from migrating into the mine waste rock. In addition to a stabilization fabric, a filter fabric or material may have to be used. A layer of sand or sandy soil spread onto the tailing surface may be used instead of a filter fabric.

Figure 2.3-3 Conceptual Plan View of Reclaimed Tailing Impoundment

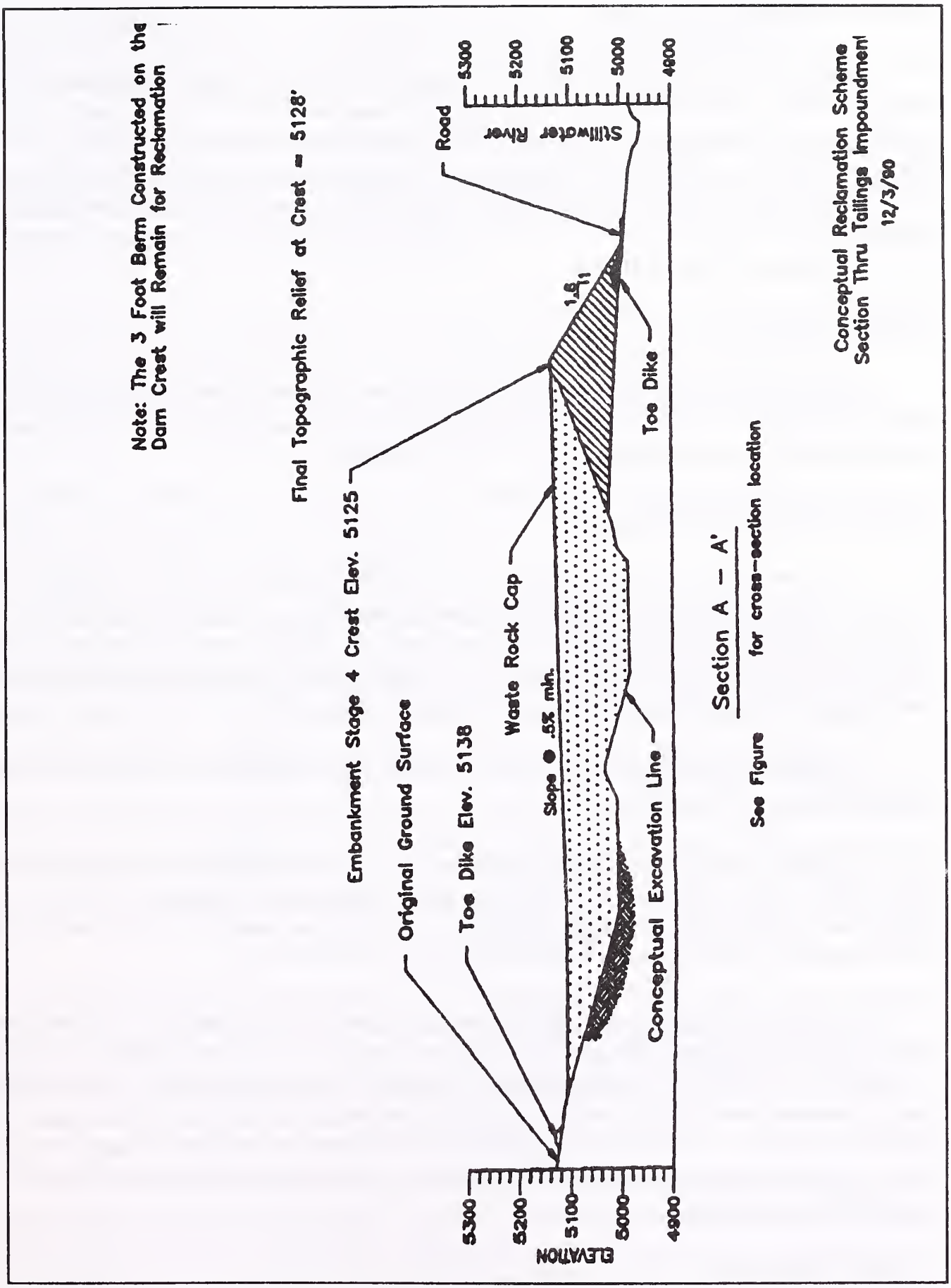

Figure 2.3-4 Conceptual Reclamation Scheme -- Section through Tailings Impoundment

2.3.18.3 Embankment Stabilization

The existing tailings embankment is constructed of mine waste rock (conventional and TBM-generated). At final reclamation, all downstream slopes constructed at approximately 1.6h:1v would remain as constructed. The steeper, reinforced embankment slopes constructed at 1.2h:1v would be reduced to 1.6h:1v at final reclamation. The final downstream slopes of the dam would be covered with riprap to reduce erosion potential. Coarse mine waste rock and on-site boulders and cobbles would be utilized for riprap. This riprap would be placed on the dam face during construction of the final stage of the embankment.

2.3.18.4 Dust Control

Final revegetation of disturbed areas other than the tailing embankment would mitigate any post-operation dust. A rock mulch, sprinkler, or chemical binder may be used, if necessary, to control dust while tailing is being dewatered prior to final revegetation.

2.3.18.5 Waste Rock Storage

All existing topsoil would be stripped from waste-rock storage areas prior to addition of waste materials. Existing topography will be utilized when constructing the waste-rock stockpiles in order to maximize visual screening potential of each storage location. Diversion ditches would be put in place during construction to divert surface water away from the waste-rock stockpiles. The final crest of the stockpiles would be backsloped towards natural ground to minimize runoff over waste-rock slopes.

Permanent storage areas would be constructed in lifts with maximum slopes of 2h:1v to allow for resoiling prior to revegetation.

Temporary storage areas would be prepared for interim revegetation once storage capacity has been reached. Once waste is removed from the temporary storage areas the site would be recontoured, resoiled and permanently revegetated. A typical cross section of a waste-rock stockpile and the east-side waste-rock berm is shown in Figures 2.3-5 and 2.3-6.

The proposed east-side waste berm/visual screen may be constructed in several segments rather than using lengthwise lifts in order to allow for timely reclamation on downstream slopes and to avoid disturbing large areas of chrome tailings at one time. The downstream face of the berm would have a maximum slope of 2h:1v which would be resoiled and revegetated when construction on the segment is complete. The inside, or upstream, face would be left at the angle of repose and would be faced with coarser waste rock until final reclamation, at which time it would also be contoured, topsoiled and revegetated.

2.3.18.6 Soil Handling

Excavation for the tailing impoundment, mill and mill complex, and percolation pond area on the west side initially provided an estimated 18,500 loose cubic yards (Lcy) of soil which were stockpiled for later use in final reclamation of the tailing impoundment, mill site, and associated

facilities. Approximately 10,000 lcy of soil were excavated and stockpiled during Stage 2 construction of the tailings impoundment in 1989. Excavation of percolation and sedimentation ponds during fall of 1990 yielded another 2,500 lcy of topsoil which were stockpiled near the pond site.

Approximately 6,000 lcy of soil materials were direct hauled to the 5300 West and 5500 West portal patios from Stage 2 excavation of the tailings impoundment. These materials were distributed on the faces of the portal patio slopes and revegetated during spring of 1989. These slopes, as contoured and revegetated, constitute final reclamation.

Soil salvaged from the tailing and facilities areas is stored in three stockpiles located adjacent to the tailing disposal site (see Figure 2.3-1). The storage piles have maximum side slopes of 2h:1v, and a minimum surface slope of 2 percent to promote surface drainage. The stockpiles were revegetated during spring 1987 and 1989. If stockpiles are disturbed by adding salvageable soils in the future, they would be revegetated as soon as practical.

Table 2.3-2 summarizes the volumes of soil salvaged from the existing facilities. Additional soil materials encountered during expansion activities would be salvaged where appropriate and either stockpiled or direct hauled, if possible, to applicable sites.

Soil salvage difficulties (large boulders) precluded the salvage of originally estimated soil volumes. The existing stockpile allows an average distribution depth of about 3 inches on the tailing impoundment surface. Because of the relative paucity of cover soil, tailing and waste rock are being reevaluated for use as a cover soil or subsoil. Preliminary analyses of waste materials indicated no phytotoxic characteristics. TBM-generated waste rock contains more fines than conventional waste rock and may provide a more suitable medium for revegetation. TBM waste has been physically and chemically characterized and on-site revegetation trials are being conducted. Early results from these trials indicate that with the addition of soil amendments, TBM waste can support adequate vegetation for at least 2 years. Detailed characterization of the waste rock and tailing is found in Sections 4.1.4 of the 1988 East Side Expansion Amendment. Refer to Sections 4.1.4, 4.2.3, 4.3.4, and 4.4.2 of the 1988 East Side Expansion Amendment for site specific details on soil handling practices.

Salvaged soil from new disturbances located in the area of the tailing facility would be hauled to and stored in the soil storage area near the upwind air monitoring site, labeled as Stockpile B on Table 2.3-2. As discussed on pages 4-12 and 4-13 of the application, this storage area would be revegetated after soils are added and the stock pile is recontoured. Soils salvaged from waste rock storage areas would be stockpiled adjacent to those storage areas.

Soils volumes to be salvaged from the areas of future disturbance were not given since estimates can vary widely and are site-specific in nature. Soil salvage estimates have been extremely inaccurate due to the variability of the terrain. Additionally, historic disturbances and activities have resulted in a real deficiency in salvageable soils. SMC is committed to the removal of salvageable soils prior to any new disturbance of ground and will continue this policy into the future. The salvaged soil would be stockpiled, stabilized, and the volumes reported to the agencies as required in the annual reclamation report.

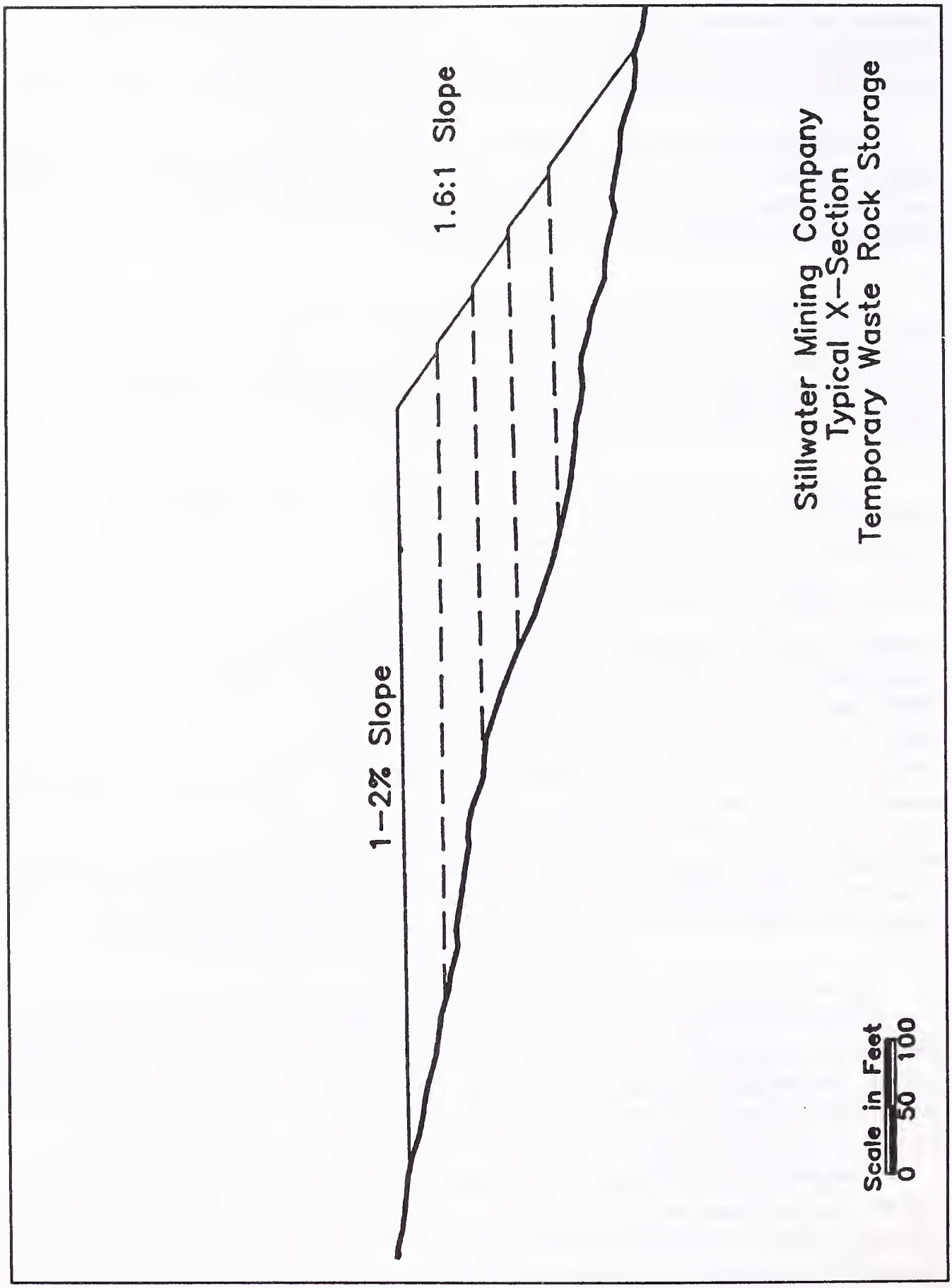

Figure 2.3-5 Typical Cross Section -- Temporary Waste Rock Storage

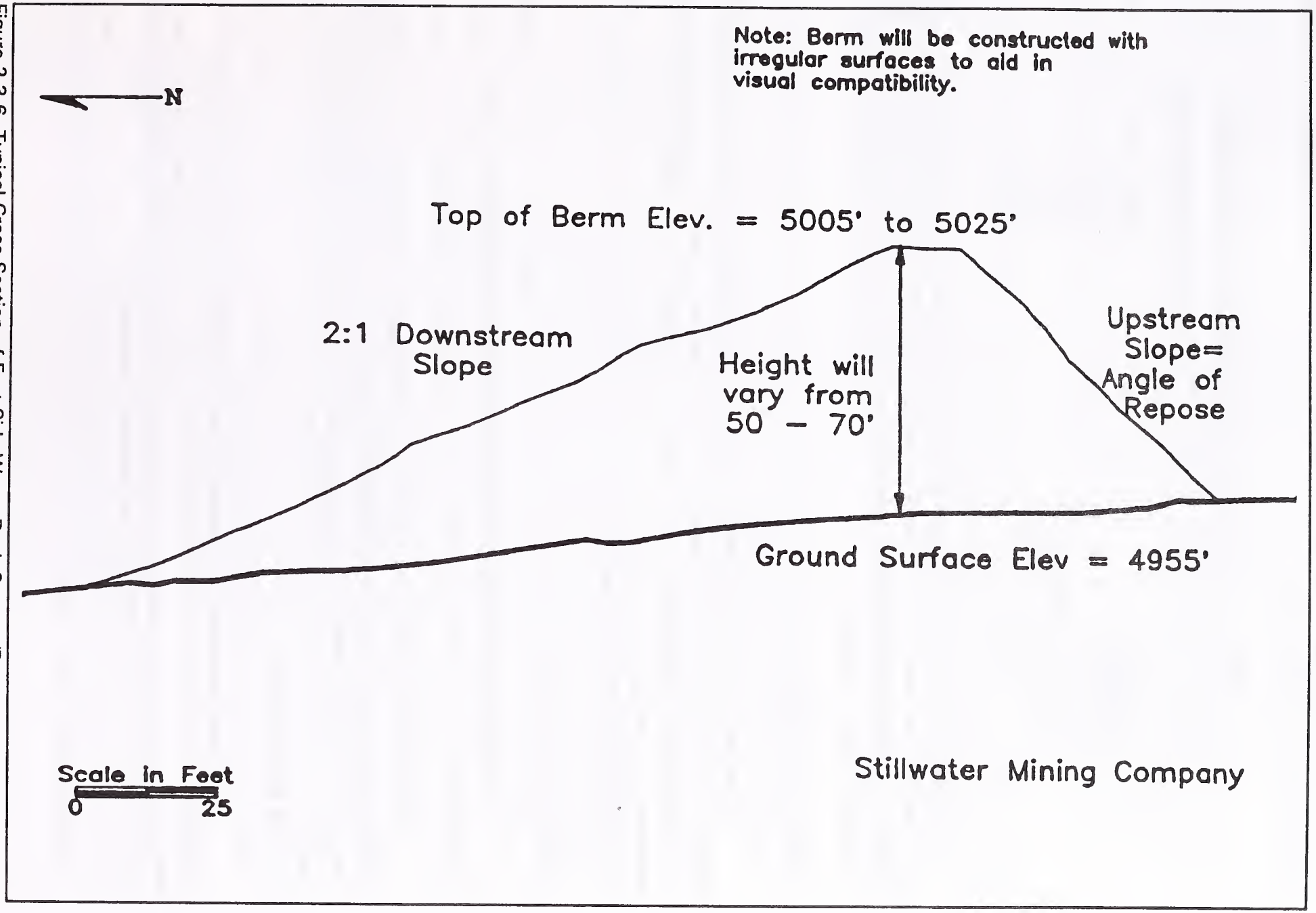
Note: Berm will be constructed with irregular surfaces to aid in visual compatibility.
N
Top of Berm Elev. = 5005' to 5025'
2:1 Downstream Slope
Height will vary from 50 - 70'
Upstream Slope= Angle of Repose
Ground Surface Elev = 4955'
Scale in Feet
0
25
Stillwater Mining Company

Figure 2.3-6 Typical Cross Section of East Side Waste Rock Storage/Berm

The following table summarizes the volumes of soil now in the five existing stockpiles. Please refer to Figure 2.3-1 for locations.

Table 2.3-2 Summary of Volume of Soil in Existing Stockpiles

SITE	VOLUME OF SOIL (lcy)
Stockpile A	17,000
Stockpile B	10,000
Stockpile C	1,500
5300W Level Stockpile	1,000
1990 Perc Pond Stockpile	2,500
TOTAL	32,000

A waste rock sampling/testing program would be initiated on an as-needed basis if substantial quantities of a nontested (foreign) waste rock type are generated during mining activities. Atypical waste rock would be tested for toxic characteristics and acid-generating potential to determine suitability for use in reclamation.

2.3.18.7 Revegetation

Revegetation procedures would be carried out on the tailings facility and on all surface facilities as outlined in the existing reclamation plan. These revegetation practices and specifics such as species selection, revegetation mixtures, seedbed preparation, seeding methods, cultural treatments, and revegetation monitoring can be found in Sections 4.1.5, 4.2.4, 4.3.5, and 4.4.3 of the 1988 East Side Expansion Amendment.

2.3.18.8 Surface Facilities

This broad category includes the mill area, office area, sedimentation, percolation and emergency ponds, service corridors, laydown areas, wells, portal facilities, and roads.

New facilities created by the expansion would be treated in the same manner as existing facilities at the time of mine closure. Refer to Sections 4.2 and 4.4 of the 1988 East Side Expansion Amendment for facility removal and reclamation procedures specified for the surface facilities.

2.3.18.9 Mine Workings

The currently permitted mine workings consist of underground facilities (adits, drifts, crosscuts, and manways), 16 portals associated with 17 adits, two headframe/shaft areas and miscellaneous mine-related disturbances. Reclamation and closure of these workings are discussed in detail in Section 4.3 of the 1988 East Side Expansion Amendment.

2.3.18.10 Facility Removal

The present plan calls for removal of all surface facilities and structures during final reclamation. At this time, however, it is impossible to predict whether it may be beneficial to leave any of the structures associated with the project in place after mine closure. No structure would be left unless it provides a beneficial use, and its existence is approved by the appropriate regulatory agencies or landowner. The railroads and conveyor systems on the mine and mill site would be salvaged, and/or appropriately disposed of. Materials of no salvage value, such as concrete and asphalt, will be buried or covered at the site, or disposed of at an approved disposal site.

All service corridors (e.g., power, above-ground water lines) that are the responsibility of SMC would be removed at mine closure, and disturbed areas would be reclaimed as necessary. Any service corridors that would not serve a future beneficial use, or that are a responsibility of SMC, would be removed at mine closure, and disturbed areas would be reclaimed as necessary. Any service corridors that would serve a future beneficial use, or that are not a responsibility of SMC, would remain in place if approved by the appropriate regulatory agencies.

All salvageable materials (e.g., exhaust fans, rails) from the underground workings would be removed and sold or transferred to other operations. Any non-salvageable material (e.g., timber, rail ties, gates, pipe, etc.) would be left in place and buried at final reclamation.

2.3.18.11 Mine Drainage

The underground workings are expected to continue to produce water after mining activities cease. The drainage would exit the workings and enter sedimentation/percolation ponds. The quality of this water is expected to be better than that produced during operations since there would be no underground activity generating sediment or nitrogen compounds from blasting. The post-closure drainage water quality is expected to approximate the groundwater quality in the region.

Following mine closure, the drainage ditches/piping, and percolation ponds near the 5000 East portal would remain in place to receive any continued flow of adit water from the 5000 East portal. Existing ponds on the west side would be reclaimed and replaced by new ponds located near and below the 5000 West portal. During final reclamation of the mill site and adjacent parking area, the percolation and sedimentation ponds would be incorporated. These ponds would receive gravity flows from the 5000 West portal. SMC would bear the maintenance responsibility of the east- and west-side water facilities, as covered under the MPDES permit. After the expiration of the MPDES permit, SMC, or any successor, would be responsible for any necessary maintenance or reclamation.

2.3.18.12 Estimated Reclamation Units and Costs

SMC estimated reclamation costs for the project at $1.7 million. This would include reclaiming the tailing impoundment, waste-rock stockpiles, mill/mine support facilities, mine workings, and roads.

2.3.19 Water Resources Monitoring Plan

The operational water resources monitoring plan for SMC was originally developed in 1986 and has been modified to include expansion on the east side in 1988 and construction of additional percolation ponds in 1990. A summary of the current monitoring program appears in Table 2.3-3. Figure 3.2-1 (Chapter 3) shows location of sampling sites.

Hydrological data for 1986-90 are included in annual reports submitted to both the DSL and DHES-WQB. No changes in the current operating monitoring plan or reporting procedures are proposed by SMC.

SMC also is required to monitor adit flows and discharge according to the terms of the current MPDES permit. This data is reported directly to the WQB and entered into EPA's nation-wide computerized database (Permit Compliance System).

SMC also maintains an extended voluntary monitoring network outside of the required operational monitoring plan. This program is a cooperative effort between SMC and adjacent landowners to establish flow and water quality for the numerous streams and springs which occur within the overlying drainage. As a voluntary plan, SMC may alter the frequencies and/or monitoring points as concerns or conditions dictate.

2.3.20 Petition for Modification of Quality of Ambient Waters

The proposed Amendment No. 008 to increase the production rate to 2,000 tpd may increase the chemical load (mass of a chemical compound or element in water) of nitrogen compounds and metals discharged to groundwater or surface water since mining would proceed at a faster rate. The petition requests a change in the water quality limits for groundwater, and for surface water in the Stillwater River to concentrations higher than the ambient concentrations. SMC Believes these changes would not cause calculable or measurable exceedances of applicable (numeric) water quality standards.

Percolation from disposal ponds (after clarification) at SMC would result in changes in the quality of ambient groundwater in the vicinity of the ponds and in the surface water in the Stillwater River. Direct discharge of adit water to the Stillwater River would result in changes in the quality of ambient water in the Stillwater River. SMC believes the groundwater and surface water quality resulting from adit water discharge would not cause calculable or detectable exceedances of applicable water quality standards. Table 2.3-4 indicates the maximum modifications of ambient water quality requested for the proposed water discharges.

SMC believes that anticipated impacts follow worst-case assumptions which may not materialize in actual mining conditions. SMC believes that current information suggests degradation of surface and groundwaters outside SMC's permit area has been undetectable at the present mining production rate. Expansion of the mining rate will only access the same ore body at a faster rate and may not increase concentration of minerals and deleterious substances in detectable quantities outside the permit area.

Table 2.3-3 Water Resources Monitoring Plan — 1990 Operational Monitoring Stillwater Mining Company

Station	Location	Spring (High Flow)	Summer (Low Flow)	Fall/Winter (Low Flow)
	SURFACE WATER			
SMC-1A	Upstream Stillwater River	X	X	X
SMC-2	Downstream Stillwater River	X	X	X
SMC-3	West Side Mine Adit Discharge at Clarifier	X	X	X
SMC-4	Decant water at mill	X	X	X
SMC-5	Upstream Mountain View Creek	X	X	X
SMC-6	Downstream Mountain View creek	X	X	X
SMC-7	Nye Creek	X	(1)	(1)
SMC-7D	Nye Creek below Percolation Ponds	X	X	X
SMC-8	No Name Creek	X	(1)	(1)
SMC-9	East Side Adit Discharge at Clarifier	X	X	X
SMC-10	Stillwater Ranch below Stillwater Valley Ranch	X	X	X

Station	Location	Winter	Spring	Summer	Fall
	GROUNDWATER (2)				
MW-5A	Downgradient tailing pond, shallow	X	X	X	X
MW-6A	Downgradient tailing pond, shallow	X	X	X	X
MW-7A	Downgradient tailing pond, shallow	X	X	X	X
MW-7B	Downgradient tailing pond, medium	X	X	X	X
MW-7C	Downgradient tailing pond, deep	X	X	X	X
MW-9	Downgradient tailing pond, shallow	X	X	X	X
MW-10	Upgradient tailing pond, shallow	X	X	X	X
MW-11	Downgradient tailing pond, shallow	X	X	X	X
T-1A	Upgradient Sed/Perc ponds, shallow	X	X	X	X
T-2	Downgradient Sed/Perc ponds, shallow	X	X	X	X
T-3A	Downgradient Sed/Perc ponds, shallow	X	X	X	X
MW-12A	Downgradient SVR Perc ponds	X	X	X	*
MW-13A	Downgradient SVR Perc ponds	X	X	X	*
MW-14A	Upgradient SVR Perc ponds	X	X	X	*
MW-15A	Downgradient SVR Perc ponds	X	X	X	*

Station	Location	Monitoring Frequency Spring	Summer	Fall
	SPRINGS			
SP-1	Upper Jones Spring - T5S, R15E, SE¼, Sec. 8		(3)	
SP-2	Buffalo Jump Spring - T5S, R15E, SE¼, NW¼, Sec. 2		(3)	
SP-3	East Side Spring - T5S, R15E, SE¼, NW¼, Sec. 22	X	(3)	X

NOTES:

(1) Samples will be collected if streams are flowing.

(2) Water Levels in all monitoring wells will be measured monthly

(3) Flow monitoring of springs will be conducted during the summer low flow period in early August.

* New wells added in 1990, sampled in November and December 1990, and January 1991.

SOURCE: SMC, 1991b

SMC estimates that the proposed production increase (Amendment No. 008) would result in an average excess adit water disposal rate of 789 gpm (Plan of Operation, page 2-14). This is an

increase of 289 gpm over the current rate. To partially mitigate water quality impacts and reduce operating costs, SMC is discontinuing the practice of pumping fresh water underground as a source of drill water (up to 150 gpm). Clarified adit water will be recycled as drill water, which will reduce adit water discharges.

SMC uses all of the adit water for spray irrigation for approximately 6 months of the year. . During the remainder of the year, adit water is routed to percolation ponds for discharge to groundwater. Adit water from either the east and west sides can be routed to any of the ponds.

Current pond capacity is in excess of that required for current adit flows, and anticipated increased flows as mining progresses.

SMC is also permitted to discharge water from the east and west adits to the Stillwater River under the terms of the existing MPDES permit (No. 0024716). There has been no point (source) discharge of water into the Stillwater River since operations began in 1986.

Table 2.3-4 Requested Change in Water Quality Limits (1)

Parameter	Montana Surface Water Quality Standard	Requested Surface Water Quality Limit	Montana Groundwater Quality Standard	Requested Groundwater Quality Limit
TDS	250	200	No standard	200
Nitrate + Nitrite	10	1	10	8
Ammonia	1.18	0.4	No standard	
Copper	0.003	0.003	No standard	
Chromium (2)	0.011	0.005	0.05	0.02
Iron	0.3	0.2	No standard	
Manganese	0.05	0.03	No standard	
Nickel	0.013	0.01	No standard	
Zinc	0.027	0.015	No standard	

(1) All values are in mg/L. Surface water standards and limits are for total recoverable metals. Groundwater quality standards and limits are for dissolved metals.

(2) Water quality standards are for hexavalent chromium. Requested limits are for total chromium, including hexavalent (Cr^{+6}) and trivalent (Cr^{+3}) chromium.

SOURCE: SMC, 1992

2.3.21 Traffic

See enclosed traffic write up.

2.4 Alternative 3 - Modifications Concerning Tailings Impoundments

2.4.1 Introduction

Four different tailing-amendment options will be analyzed. To facilitate understanding and comparison of these options, all four will be discussed in Alternative 3 as 3a (No Action), 3b

(Company Proposal), 3c (Partial Approved) and 3d (Approved with Modification). Table 2.4-1 shows specifications for each option. Impacts to other resources may be specific to an option or may be examined in general terms.

2.4.2 Decision-Makers' Selection

The decision makers, the Forest Supervisor of the Custer National Forest and Commissioner of State Lands, would incorporate one of these Alternative 3 options: 3a, 3b, 3c, or 3d, with other alternatives. For example, Impoundment Alternative 3d could be incorporated into either the Company's Proposal (Alternative 2) or the Proposed Action with Modifications (Alternative 5). This allows flexibility to the decision makers while maintaining a fairly simple structure for analysis and impact disclosure.

2.4.3a No Action - 3a

The no-action alternative for tailing impoundments would maintain SMC's current approved plan of operations at a production of the mine to 1,000 tpd. All currently approved activities would continue. The tailing impoundment is currently permitted to be constructed in stages. Stages I and II are complete. Stage III construction would begin in 1992 and would be completed in 1997. Stage IV would begin construction in 1997, with completion in 2000. At the maximum tailing production rate of 1000 tpd ore production, the impoundment life would extend through the year 2013. The reclamation plan, which calls for complete grass revegetation at 2h:1v slopes, would remain in effect.

Alternative 3a is included because it allows the decision makers to maintain presently approved levels of ore and tailing production.

2.4.3b Company's Proposal - 3b

In Alternative 3b SMC proposes to increase production to 2,000 tpd. To accommodate the increased amount of tailing generated by doubling production, the impoundment area would be expanded by 4 acres and the height increased by 14 feet over presently permitted dimensions. Capacity would be augmented by steepening impoundment slopes to 1.6h:1v during both operation and reclamation. Impoundment capacity would be reached in 2008. Reclamation would be modified to rock armoring the slopes while maintaining grass vegetation on the impoundment surface.

Alternative 3b is included because it is SMC's proposal, and allows expansion of tailing capacity with the least ground disturbance.

2.4.3c Partial Approval - 3c

The partial-approval alternative would allow SMC to expand production to 2,000 tpd, but would not allow modification of the tailing facility. Size, capacity, slopes and reclamation would all remain as presently permitted (see No-Action Alternative 3a and Stillwater EIS). Construction of Stage III of the facility would begin in 1992. With no impoundment modifications, the increased production rate would result in the filling of the permitted facility by 2003.

With the uncertainty of future economic conditions such as mining costs or platinum/palladium prices, it is impossible to predict the actual mine life. If continued mining activities at SMC were to require a new tailing facility, the impacts of that facility would be assessed and disclosed in a future NEPA/MEPA document.

Table 2.4-1 Tailing Impoundment Alternatives

Impoundment Specifications	3a. No Action	3b. Company Proposal	3c. Partial Approval	3d. Modified Impoundment
Impoundment area	66 acres	70 acres	66 acres	75 acres
ponded area	39 acres	44 acres	39 acres	44 acres
embankment slope area	66 acres	42 acres	66 acres	62 acres
Dam crest elevation	5,111 feet	5,125	5,111 feet	5,125 feet
width	20 feet	20 feet	20 feet	20 feet
maximum height	141 feet	155 feet	141 feet	155 feet
Freeboard above maximum tailing elevation	9 feet	4 feet, plus a 3-foot berm	9 feet	4 feet, plus a 3-foot berm
Storage capacity @ tailing elevation	5,102 feet	5,121 feet	5,102 feet	5,121 feet
cubic yards	3.75×10^6 yd^3	5.3×10^6 yd^3	3.75×10^6 yd^3	5.3×10^6 yd^3
tons of tailing @ average dry density = 70 lb/ft^3	3.5×10^6 tons	5.0×10^6 tons	3.5×10^6 tons	5.0×10^6 tons
Embankment volume	2.1×10^6 yd^3	2.7×10^6 yd^3	2.1×10^6 yd^3	3.1×10^6 yd^3
impoundment borrow	819,000 yd^3	819,000 yd^3	819,000 yd^3	819,000 yd^3
waste rock fill	1,281,000 yd^3	1,891,000 yd^3	1,281,000 yd^3	2.3×10^6yd^3
efficiency ratio (embankment volume/impoundment volume)	.56	.51	.56	.58
Maximum tailing production rate	380 tons per day	760 tons per day	760 tons per day	760 tons per day
impoundment life	22 years, through year 2013	17 years, through year 2008	12 years, through year 2003	17 years, through year 2008
Maximum ore production rate	1,000 tons per day	2,000 tons per day	2,000 tons per day	2,000 tons per day
total ore production over life of the impoundment	9.2×10^6 tons	13.16×10^6	9.2×10^6 tons	13.16×10^6 tons
Residual waste rock storage associated with the alternative and not used in construction or reclamation.	None	330,000 yd^3	None	A 250,000 yd^3 deficit.
Stability: minimum factors of safety against mass instability — static:	1.8	1.5	1.8	≤1.8
pseudostatic: (seismic)	1.3	1.1	1.3	≤1.3

2.4.3d Modified Impoundment - 3d

Under Alternative 3d, modified impoundment, production would increase to 2,000 tpd and the proposed tailing impoundment would be changed. Height would be increased 14 feet to elevation 5,125. The toe would be moved outward because of the increased height, expanding the total area to 75 acres. 2h:1v slopes and grass revegetation would be maintained as permitted, except along the south dam face, where FS Road No. 846 and Mountain View Creek are located. Here the dam would be steepened to 1.6h:1v and would be rock armored at reclamation. County Road FAS 419 would have to be relocated toward the Stillwater River to accommodate the increased impoundment size. These modifications would increase capacity so that the facility's life would be the year 2008.

Alternative 3d was developed by the agencies in an attempt to increase capacity while maintaining 2h:1v slopes for stability and reclamation.

2.5 Alternative 4 - Water Treatment

During preliminary analysis of the SMC Application, the WQB determined that the proposed expansion would constitute a new or enlarged source of pollution and was therefore subject to Montana's nondegradation rules (ARM 16.20.701 et seq.). Degradation is defined as the increase in concentration of certain regulated substances above ambient (background) levels and may only be allowed by the BHES based on necessary social and economic concerns (75-5-303(1), MCA). Degradation is applied differently for surface and groundwater.

To achieve the proposed rate of production, SMC would have to double the annual amount of explosive compounds used underground. The increased usage of explosives would increase the load (mass per time) of nitrogen compounds and other constituents, and may increase the concentration (mass per volume) of nitrogen compounds in the adit water. Therefore, SMC submitted a petition for change of ambient water quality. The petition is considered part of the company's proposal.

Nondegradation applies to toxic and deleterious substances, and certain other substances, in surface water (ARM 16.20.701). Montana has adopted EPA's "Gold Book," EPA, 1986, which contains numerical standards for toxic and deleterious substances. In groundwater, nondegradation applies to any parameter for which there is a Maximum Contaminant Level (ARM 16.20.1003(4)) or any pollutant that may adversely affect a beneficial use (ARM 16.20.1011). Presently, both nitrate and certain metals listed in the Gold Book are subject to the nondegradation rules.

Nondegradation applies to surface and groundwater outside of a mixing zone [ARM 16.20.701(1)]. Groundwater within the SMC property boundary is considered the mixing zone [ARM 16.20.1001(6)]. For surface water, a mixing zone is the area in which effluent and receiving water mix and is characteristically different from the receiving water [ARM 16.20.603(12)].

An MPDES permit was issued in 1979 for discharge of adit water from the Minneapolis Adit to the Stillwater River. Effluent limitations for metals were based on ambient levels (nondegradation) but nitrate was not subject to nondegradation rules at that time. Based on ecological concerns, total nitrogen was specified in the permit not to exceed 1 mg/L at the lower monitoring site.

SMC has never discharged to the Stillwater River under the terms of the MPDES permit. The primary means of disposing of excess adit water is to land apply (irrigate) or to percolate after conventional treatment. Under the groundwater rules, facilities with operating permits issued under the Metal Mine Reclamation Act are excluded from the permitting requirements of groundwater rules [ARM 16.20.1012(1)(m)]. SMC has operated under an operating permit since 1986. However, nondegradation, as well as all other water quality standards, apply to the SMC operation and are administered by both DSL and the WQB.

The levels of nitrate, TDS and metals, at the date SMC submitted the petition are used in Chapter 3 for the purpose of establishing existing concentrations. For the purpose of analyzing the company's proposal in Chapter 4, the no-action alternative is evaluated based on the existing water quality plus the currently permitted discharge.

The three options presented in Alternative 4 provide a range of choices available to the Forest Service, DSL and the BHES regarding water quality. Alternative 5 includes agency modifications to the proposed action and contains additional water quality monitoring and mitigation measures. The decision to be made by the BHES would be to grant or deny the petition, with or without conditions. A Record of Decision (ROD) will be prepared by the Forest Service and DSL following the BHES hearing and decision. The findings of the Board will be considered in developing the ROD.

2.5.1 No Action - 4a

Under this alternative SMC would continue to mine at 1,000 tpd. Present levels of discharge and contaminants would not be exceeded. The present system of treating and disposing of adit water would be maintained. Since no new or enlarged source of pollution would exist, SMC would not be subject to Montana's nondegradation rules other than those presently in effect for metals in the MPDES permit. The MPDES permit would be renewed based on the current effluent limitations.

Presently, SMC applies conventional treatment to adit water before land applying or routing the effluent to percolation ponds. Conventional treatment involves the removal of suspended solids and associated metals but is not effective for removal of nutrients. The existing treatment is discussed in this section but would apply to options 4b and 4c.

Clarification

The sediment laden water from the adits reports to a 30-foot diameter conical steel tank and is directed downward and outward. The heavier solid particles migrate downward and are drawn out the bottom through the under-flow pump. The process is facilitated by the use of a chemical flocculent. Overflow, or clarified water, is collected at the surface along the perimeter of the tank. The settled material, or underflow, is slurried to the lined tailings impoundment.

The mill and tailings impoundment are non-discharge facilities. That is, water is contained and recycled in the milling process. When necessary, adit water is directed to the mill circuit as make-up water.

2.5.2 Company's Proposal - 4b

The proposed action is described fully in Section 2.3. This alternative evaluates granting of the petition at the levels proposed by SMC (Section 2.3.20). However, BHES may grant the petition at levels less than the requested amount.

The BHES may grant a request for degradation of ambient water quality if it is demonstrated that beneficial uses would not be adversely impacted and the change is justified based on social and economic development. Further, the Water Quality Act requires any source of pollution subject to the nondegradation provisions to provide treatment of waste water. Both state and federal regulations have been promulgated describing treatment control technologies for surface water discharges. The treatment proposed by SMC is to maintain the present level of treatment described in Alternative 4a.

If the petition were granted, the effluent limitations in SMC's MPDES permit would be renewed based on the ambient concentrations requested in the petition and approved by the BHES. Similarly, groundwater concentrations would be maintained at the level requested in the petition and approved by the Board.

2.5.3 Advanced Water Treatments - 4c

Advanced water treatment of adit water would allow the company to expand production to 2,000 tpd without degradation of state water. This alternative evaluates denial of SMC's Petition for Modification of Ambient Waters (SMC, 1991a). Conventional treatment is not effective for the removal of nutrients and dissolved metals and therefore consideration of advanced treatment is warranted.

Montana's nondegradation rules require alternatives to the proposed action that result in less or no degradation. In the petition, SMC proposed three advanced treatment options: reverse osmosis; ion exchange; and forced evaporation. These options, as well as others, would be available to SMC if the BHES denied or modified SMC's petition.

In evaluating these advanced treatment options, it is not the agencies' intent to specify operating policy and procedures to SMC, but rather to inform the BHES and the public that alternative treatment techniques are available. If the petition were denied, SMC would be required to submit a plan to the agencies that would maintain water quality at ambient levels before approval to expand to 2,000 tpd were granted. This plan may, or may not, include advanced treatment of some, or all, of the adit water. SMC would be required to maintain the existing load (mass per time) of nutrients and metals. Concentration (mass per volume) may increase or decrease depending on the volume of water encountered during operation. Based on the agencies' experience at other locations, treatment may be required for 1-2 years after SMC ceases operations. Water treatment in perpetuity would not be necessary.

Reverse Osmosis

Reverse osmosis is a treatment process whereby contaminants from aqueous wastes are removed by passing the waste stream, at relatively high pressure, through a semipermeable membrane. At typical operating pressures of 200 to 800 psi (pounds per square inch), clean water or permeate (the liquid being treated) is forced through the membrane, leaving a concentrated waste stream of reduced volume behind as membrane rejection. Reverse osmosis removes approximately 90 percent of dissolved chemical constituents from feed water and up to 97 percent of nitrogen in typical wastewaters. Treatment efficiencies for discharge of the type being considered on this project are not known. It requires a relatively particulate-free feedwater to prevent membrane fouling. Prior treatment of the feedwater through a conventional technology such as sand filtration could be used to remove the suspended solids and prevent membrane fouling.

Approximately 5 to 10 percent of the feedwater would be rejected through the process and must be disposed of or evaporated. This can present a problem because the rejected water could contain 10 times or more higher concentrations of metals, dissolved solids, and other compounds. A number of disposal options exist to handle the reject water, including: transporting to an acceptable sewage treatment plant, land application disposal, or additional treatment such as forced evaporation. Forced evaporation would generate approximately 320 yd^3 of dry solids per year which would need to be disposed of at an appropriate disposal facility. Depending on the amount of metals present in the solid waste, a biological treatment such as land farming could be used to reduce organic contaminant concentrations. The waste generated could conceivably have metals concentrations high enough that the waste would classify as a characteristic hazardous waste under the provisions of the Resource Conservation and Recovery Act of 1976, as amended (RCRA). This would necessitate use of a permitted hazardous waste disposal facility unless a properly protective disposal cell could be sited in the mine permit area.

Ion Exchange

Ion exchange is based on a principal of interchangeable ions between a solid and a fluid mixture. Ions are atoms, groups of atoms or, in some instances, molecules, which have acquired a net electrical charge, either positive or negative. Cations are exchanged for hydrogen or sodium and anions for hydroxyl ions. Most ion-exchange resins used in waste water treatment are synthetic resins. Treatment involves a sequence of operating steps. The wastewater is passed through the resin until the available exchange sites are filled and the contaminant appears in the effluent. At this point the process is stopped and the bed is backwashed to remove dirt and to regenerate the resin. The removed product/contaminant from the wastewater stream can be concentrated for more controlled disposal. This process is commonly used in water softening systems.

Since the ion exchange will not convert ammonia or nitrite to the nitrate form, a pre-treatment step of biological denitrification would be required. The denitrification process requires a large amount of organic carbon, typically in methanol form, which may or may not be present at the site. It is possible that the sewage waste generated on site could provide some or all of the required carbon, or carbon sources would need to be imported from off site. Two problems with denitrification at this facility would include the need for a constant flow to regulate microbial (biological) activity, and the

cold weather present during most times of the year which inhibits microbial decay. Specific design considerations may be able to address these problems.

Another pre-treatment step would be the removal of suspended solids from the feed water. This could probably be achieved using a sand filtration unit.

According to SMC (1991a), ion exchange is reported to result in a 70-percent nitrate reduction in this discharge. Ion exchange can conceivably be designed and sized to achieve even greater nitrate removal efficiencies.

Ion exchange resin would need to be backwashed frequently to prevent biological fouling of the unit. This activity would require approximately 3,000 lb/day of salt and result in large quantities of brine waste, estimated by SMC at 30,000 gpd, requiring disposal or biological treatment. Forced evaporation of this waste stream would probably be preferred rather than land application or deep well injection. Forced evaporation would generate approximately 700 yd^3 of dry solids per year which could be trucked to an off-site disposal facility or placed in an appropriate on-site disposal cell. The waste generated could conceivably have metals concentrations high enough that the waste would classify as a characteristic hazardous waste under the provisions of RCRA. This would necessitate use of a permitted hazardous waste disposal facility, assuming the waste is not prohibited from land disposal.

Forced Evaporation

Although forced evaporation is believed unproven as a means of nitrate reduction, it does have development advantages, most significant being that minimal discharge would be required. A brief discussion is included here.

The evaporator consists of a vertical tube, falling film unit which reduces the volume of water to approximately one percent of the original feedwater volume. The concentrated wastewater (approximately 7.5 gpm based on an original feed rate of 737 gpm), containing elevated levels of metal salts and other compounds, would be disposed in an appropriate disposal cell to allow evaporation of the liquid.

The proposed units are modular to allow flexibility of placement and rapid relocation, as well as the capability for reconfiguration to expand capacity. This flexibility would likely not be necessary at the SMC facility where all mine water could be routed to a common point.

Power requirements are very high for this process. Approximately 80 kilowatt-hours of electricity per 1,000 gallons of wastewater would be required to power the unit. Approximately 3 person-hours per shift would be required to run the unit to perform routine maintenance and monitoring. Routine maintenance shutdown would occur annually for a period of approximately 10 days.

Pretreatment

All of the treatment options discussed above would require pretreatment for the removal of suspended solids. Although SMC currently applies a form of solids removal (clarification), additional solids removal would be required before advanced treatment could be applied. Typical methods of solids removal include coagulation, flocculation, sedimentation and filtration. SMC has proposed sand filters as a pretreatment for reverse osmosis, ion exchange and forced evaporation. Sand filtration could be used either as pretreatment, or, as an add-on to the existing treatment system. Solids generated by pretreatment would be similar to tailing material and could be disposed of in the tailing impoundment.

Efficient use of conventional treatment technologies would reduce the concentration of most metals to below ambient levels; however, these processes alone have very little impact on nitrate concentrations. SMC would be required to provide additional treatment for solids removal before direct discharge.

Cost of Advanced Treatment Options

Treatment technologies and costs presented in the SMC petition are identical to those developed in Stillwater PGM Resources (SPGMR) East Boulder Project petition (SPGMR, 1991. The agencies conducted an independent analysis of these treatment technologies in support of the East Boulder EIS. Due to the similarity of these two projects, this analysis was used to facilitate the SMC project.

It is important to note that additional information on feed stream parameters, site location, discharge points, flow rates, power requirements, and many other variables would be needed in order to accurately cost and configure a treatment system. One of the most critical variables that would need to be defined is the quantity of water to be treated. The following analysis is based on treatment of the entire effluent stream, that is, 789 gpm. It is likely that only a portion of the effluent stream would require treatment, and therefore, the values presented here may over-estimate actual treatment costs.

In the petition, SMC estimated that major treatment components would require replacement after 20 years. The agencies do not believe that treatment systems would require complete replacement after 20 years. Many components, such as external structures or mixing tanks would not need replacement for much longer, while other components such as multi-media filters would require more frequent replacement. Also, the mine life is projected at approximately 25 years; it is not reasonable to think that a complete new treatment system would be installed with only five years of life remaining.

Treatment costs and removal efficiencies are summarized in Table 2.5-1. All estimates include a pretreatment step. Additional information regarding the agencies' cost estimates may be reviewed in the project files at the Department of State Lands and Water Quality Bureau (DHES) offices in Helena.

2.6 Proposed Action with Modifications - Alternative 5

The agencies have reviewed SMC's proposal and determined potential environmental consequences (see Chapter 4). Alternative 5 was developed to mitigate certain adverse impacts of SMC's proposed plan, and provides specific requirements to be added to SMC's proposed action described in section 2.3. Alternative 5 also includes additional monitoring which is intended to evaluate the effectiveness of the proposed mitigation and validate the analytic assumptions and predictions developed by the agencies. This option could be selected in combination with any ambient level selected (4b or 4c), or in combination with Alternatives 2 or 3. There are no mitigation measures developed for air quality and socioeconomic issues.

2.6.1 Water Resources

Modified Water Resources Monitoring Plan

SMC presently maintains a fixed station monitoring program with annual submittal of results to the agencies. The water resources monitoring plan would be updated to incorporate lower detection limits, where appropriate and achievable. The current practice of using EPA approved analytical procedures would be maintained. Lower detection limits are necessary to assure compliance with the nondegradation requirements.

The present monitoring plan would be modified to sample the SVR (Stillwater Valley Ranch) monitoring wells (MW 12A, 13A, 14A and 15A) monthly during the period of the year when the ponds are in use. This additional sampling would include nitrite plus nitrate, ammonia, and total dissolved solids (TDS). Also, additional monitoring locations would be added downstream of the SMC mine site.

Additional Groundwater Monitoring

Groundwater to the north of the SMC permit boundary, on the west side of the Stillwater River, is not adequately monitored by the present system of monitoring wells. The present and potential beneficial uses of this water include domestic consumption. Based on monitoring of the existing west side wells, nitrate levels are currently elevated in this vicinity. Test data from MW-9 and MW-11 indicate significant dilution, but projections beyond this point are not reliable. Additional monitoring would also be designed to address the impacts of the existing and/or enlarged west side drain field. Predictions of phosphorus and nitrogen loading could then be substantiated.

Similarly, additional wells, monitoring wells, would be installed in the vicinity of the SVR percolation ponds which would be used to substantiate the degree of groundwater mixing in this area.

SMC would be required to submit a plan to install additional monitoring wells for agency approval. The monitoring wells would be located near the property boundary to assess off-site impacts and would be used as a point of compliance for groundwater monitoring. Upon completion of additional wells and collection of data, SMC would be required to submit an updated groundwater map

Table 2.5-1 Comparison of Conventional and Advanced Water Treatment Options

Treatment Alternative	Treatment Category C-conventional A-advanced	Components			Removal Efficiency (%) or Final Concentration[b]					Costs (millions of Dollars)[1]		Total Energy Requirements kWh/day
		Sand Filter	Forced Evaporation	Brine By-Product	Suspended Solids	Dissolved Solids	Ammonia	Nitrate	Metals	Initial	Annual O & M	
Clarifier	C	Yes (optional)[a]	No (No)	No (No)	99%	0	0	0	50-99%	1.13 (*)**	.25 (*)	860
Reverse Osmosis	A	Yes (Yes)	Yes (Yes)	Yes-150 GPM (Yes-60 GPM)	>99%	90%	95%	1.0 mg/L	90%	5.60 (4.27)	2.09 (.67)	18,480 (1,800)
Ion Exchange	A	Yes (Yes)	Yes (Yes)	Yes-28 GPM (Yes-21 GPM)	>99%	<5%	90%	<1.0 mg/L	90%	4.41 (1.03)	1.08 (.18)	7,520 (3,124)
Forced Evaporation	A	No (No)	Yes (Yes)	Yes (Yes-7.5 GPM)	>99%	5 mg/L	Varies	>99%	99%	6.06 (9.50)	2.09 (1.75)	68,750 (80,000)

a Items denoted by parentheses are SMC's assumptions and cost estimates

b These are typical removal efficiencies for wastewater treatment streams. Treatability testing is required to validate efficiencies.

c Also includes nitrification systems

d Agency costs include a 3-million gallon lined retention pond (3 days storage) in the event of equipment downtime.

e (*) Information not provided or distributed in other costs by SMC.

f Includes membrane replacement every 4 years.

g Includes resin replacement every 4 years.

including the east and west side. The frequency and/or number of parameters analyzed at existing sites may be reduced if, after consultation with the agencies, these sites are considered redundant.

LAD Identification and monitoring.

Land Application Disposal (LAD) through spray irrigation is a proven and valuable method for reduction of nutrients and metals. However, this practice should be monitored to document the continued capability of the soil to maintain this level of removal and any measurable build up in trace elements.

SMC would be required to submit to the agencies an updated map delineating LAD areas. This map would include soil types based on the most recent soil survey information. Each soil type would be sampled on two locations annually for soil pH, cation exchange capacity (CEC) and trace elements. Samples would be taken at 0 to 6 inches, 6 to 12 inches and greater than 12 inches. SMC would be required to maintain soil pH greater than 6.5. Land application off the SMC permit boundary would be subject to similar requirements.

Biological Monitoring Program

Because nitrate has been identified by the agencies as a possible concern, SMC would be required to develop a program to sample periphyton. This program should be designed to assess existing conditions relative to pre-permitting baseline studies. Natural and artificial substrates would be included to assess algal biomass and community structure. Agency approval of the plan would be required before expansion was permitted.

Mine Water Discharge - Reclamation

Maintenance of the percolation ponds would be necessary until water quality parameters are met. Once the water quality reaches acceptable limits of quality and quantity, the pond can be breached and a channel constructed to allow the flow from the pond to reach a natural drainage course. For bonding purposes, SMC must submit a plan for perpetual pond maintenance, and a channel plan detailing how the water would be routed to natural drainages. However, based on the agencies' experience at other locations, treatment may be required for 1-2 years after SMC ceases operations.

2.6.2 Tailing Impoundment Reclamation/Revegetation

Reclamation of the tailing impoundment surface and embankment would be difficult (see Chapter 4). Modifications to the proposed action are needed to 1) maintain embankment stability; 2) minimize loss of biological diversity by increasing soil replacement depths on the embankment slope and impoundment surface and limiting use of rock armor on the embankment face; 3) limit visual impacts by enhancing reclamation on the embankment face; and 4) maintain the ability to use heavy equipment on the reclaimed embankment slopes. A specific plan addressing these issues and reclamation of the impoundment must be submitted by SMC for agency approval by January 1, 1993. Mitigations to be part of the plan include:

1) Maintenance of approved slope stability factors of safety;

2) A detailed embankment slope reclamation plan is needed using a mosaic of rock armor placed asymmetrically across the slope to break slope length and increase soil to rock ratios. Some rock armor is needed to reduce soil loss to erosion. Soil loss calculations indicate slope length must be reduced to 50 feet or less. Deeper soil replacement depths would enhance revegetation success. Define the depth of glacial till or alluvium needed for a subsoil layer to enhance revegetation success and achieve comparable stability and utility with the pre-disturbance soils in the area. Use of till and/or alluvium rather than waste rock would minimize the potential for piping of the replaced topsoil into a waste rock subsoil layer. Soil loss calculations indicate the need for replacement soils to have at least 50 percent coarse fragments to reduce soil loss to acceptable levels. Vegetation selected should be based on biological diversity and visual screening ability to help break the long linear lines of the embankment crest.

The currently approved reclamation plan for the tailing surface may be optimistic especially concerning the amount and rate of tailing settlement and the degree of impoundment consolidation at closure. The consequences of underestimating settlement could include an inability to sustain the required reclamation gradient, subsequent precipitation recharge and saturation of the tailing mass and cap materials, and vegetation failure. The following procedures would be required at closure to provide definitive design criteria for reclamation:

Conduct tests of the in-place tailing, at sufficient grid spacing and depth, to define the range of impounded tailing materials properties.

From field testing, determine the degree of consolidation and settlement, including 1) estimate the amount of capping settlement that may result from pore pressure dissipation and primary consolidation, 2) reclamation cap placement and surcharge consolidation, and 3) long-term secondary consolidation.

Estimate the depths and volumes of reclamation cap fill that will be required to achieve necessary post-settlement gradients.

Address the amount of alluvium and/or glacial till needed as subsoil to increase replacement soil depths to levels that approximate those in the area before mining.

Provide a plan to test and verify the lack of acid producing potential in the tailing mass over the entire mine life.

2.6.3 Waste Rock

A plan for more detailed monitoring of waste-rock types and volumes would be developed by SMC and approved by the agencies. The plan should include details of static and kinetic testing to be

conducted in case waste rock is encountered that falls in the range of -20 to +20 tons of lime needed to neutralize 1,000 tons of waste rock. Particular attention would be given to waste rock from faults and lithologic contact zones.

2.6.4 Soils

Reevaluation of soil salvage in all disturbed areas is needed because of the change in standards since 1985. The use of soils with less than 1 percent organic matter and with coarse fragment contents of 50 to 75 percent as subsoils under the salvaged topsoil already stockpiled at the mine can enhance reclamation success to comparable stability and utility in the area. Inspections would be conducted by the agencies during soil salvage operations.

2.6.5 Wildlife

Habitat improvement would be required to replace acreage lost to new disturbance.

2.6.6 Aesthetics

Proper visual quality mitigation measures for this project involve the establishment of a natural variety of vegetation and land form on the tailings embankment based on available construction materials and site characteristics at the time of final reclamation, the interruption of the flat line formed by the top of the dam, and the screening of the administrative area and parking lot from the most common viewpoints.

The character of the surrounding landscape relates more readily to steep slopes than horizontal planes so blending the embankment into the area would not be as difficult as disrupting this hard line imposed by the dam crest. The methods for breaking this line and adding variety to the slope surface, however, are the same and differ only in where they are applied. These recommended visual quality mitigation measures include the use of boulders, large and small native shrubs, and large and small native tree specimens. Wind scouring will make establishment of large trees difficult. Establishment of shrubs or trees should only be undertaken at final reclamation.

Boulders used singly or in groups relieve the monotony of an otherwise smooth slope and relate strongly to the character of the surrounding environment. These large, locally obtained rocks can be placed and partially buried across the embankment at irregular intervals. Used judiciously and in conjunction with plant material, they can also be the basis for disguising the top of the dam and even the parking lot.

The use of various sizes of native trees and shrubs is essential in mitigating both short and long-term objectives. Random massings of trees, shrubs, rocks and combinations of the three will help achieve objectives for the slope of the embankment as viewed from the valley highway and Cathedral Ranch. Use of these plant materials will not meet foreground requirements in the short term but will greatly reduce the time it takes to eventually achieve the Retention of Visual Quality Objectives (VQO) over the life of the mining operation. In addition, specimens of large native conifers

placed around the parking area would partially screen both the cars and buildings from views from the valley, help block machine noise, and reduce glare from night lighting.

2.6.7 Traffic

Although the 3.0 passenger/vehicle mitigation will remain, two changes would be implemented. Employees living within 10 miles of the mine would be exempt, and data collection and reporting to the proper regulatory agencies would only be required in March and September.

2.7 Other Related Development Activities

Within the general project area there are other activities occurring currently or in the future which should be considered due to potential additional cumulative environmental impacts. In other words some activities may directly contribute either positive or negative environmental impacts which, when considered in conjunction with impacts created by implementation of SMC's 2,000-tpd proposed amendment, lessen or increase the overall impact upon the quality of the human environment.

The purpose of this section is to identify the related development activities which need to be considered for cumulative impacts, and to provide the rationale as to why those activities are related.

The basis of this assessment of related development activities lies within the recently completed Stillwater Complex Integrated Resource Analysis (IRA) prepared by the Beartooth District of the CNF and the Big Timber District of the GNF. The IRA is an analysis of a geographic area, know as the Stillwater Complex, for the purpose of implementing the Custer and Gallatin National Forest Plans. The IRA includes a discussion on how projects were assessed using a "Reasonable and Foreseeable" development scenario. The area in question consists of approximately 193,243 acres in south-central Montana. The study area is bordered on the south by the Absaroka-Beartooth Wilderness. The IRA is available for review at the Custer National Forest Supervisor's office in Billings, the Beartooth Ranger District in Red Lodge, or the Big Timber Ranger District in Big Timber.

The location of the proposed 2,000-tpd amendment is within the boundary of the Stillwater IRA and therefore the document was used as a guide to determine and assess other development activities. As a means of determining which activities or potential development within the complex should be evaluated a review was conducted of all Projects of Concern identified in the IRA. Projects of Concern were identified by applying the following four criteria:

1. Projects which may have impact in terms of;
   * Knowledge of issues and concerns
   * Past experience with similar projects
   * Overall consequences, and therefore the preparation of either an environmental assessment or environmental impact statement
2. Projects causing earth disturbance
3. Projects having major issues or concerns

4. Projects required by laws, regulations, or direction to be analyzed, such as those having an effect on roadless classification or threatened, endangered, or sensitive species.

Each Project of Concern was evaluated to determine if it had environmental consequences related to SMC's 2,000-tpd proposal in terms of geographical impact area. An initial list of related development activities was prepared by reviewing those Projects of Concern which are or would occur in habitat used by wildlife that could be impacted by SMC's proposed action. Wildlife was selected as an "indicator" resource because of the wide ranging migration routes and range for species such as elk and deer. In other words, more Projects of Concern will be evaluated for impacts to wildlife than for any other resource because of the potential impacts for such a large geographical area. The following subsections identify Projects of Concern that may impact wildlife and other resources that could also be affected by the SMC proposal. A more detailed description of each Project of Concern may be found in the Stillwater IRA. Most environmental resources need to consider a much smaller impact area than wildlife; for instance, concerns about cumulative effects to surface and groundwaters are limited to development activities within the Stillwater River Drainage. Therefore, wildlife is by far the most prevalent resource of concern for the following projects.

In order to track the duration of proposed project impacts the following codes will appear at the end of each project description. This information is helpful in assessing when projects will impact surrounding resources, and when the effects of these projects will subside.

PD	Project Duration
PI	Project Implementation
PR	Project Reclamation
NEPA	Year of NEPA Documentation

The following projects considered for cumulative effects evaluations will be listed under the resource which would most likely be impacted due to implementation of that project. A single project may appear under more that one resource category if more than one potential cumulative effect has been identified.

2.7.1 Projects of Concern Evaluated (CNF)

The following projects are expected to have some degree of cumulative effects within the project area, when considered in combination with SMC's 2,000-tpd proposal.

Wildlife

(Rg 106) Horseman Flat Range Improvement Construct 0.75 mile of livestock water pipeline and 0.5 mile of pasture division fence in Horseman Flat allotment in the N½ Sec. 8 T5S, R15E. (PD:1991-1992; NEPA:1991; PI:1992; PR:1992) This project is included due to potential forage and cover impacts. This project is planned to occur adjacent to the mining complex.

(Rg 107) Horseman Flat Conifer Treatment Treat 200 acres of conifer encroachment in Horseman Flat allotment, through prescribed fire, post and pole sale or firewood collection. Sec. 9 T5S, R15E. (PD:1991-1992; NEPA:1992; PI:1992; PR:NA) This project will affect the amount and distribution of wildlife and domestic livestock use by providing additional forage for these animals.

(M104) Chrome Corporation of America-Mountain View/Mouat Mine Project. Continued chrome ore exploration and evaluation. Project disturbance is approximately 0.5 acre per year, therefore, by close of the project a little less than 3 acres will be affected. (PD:1990-1993; NEPA:On-going per yearly plan of operations submittal; PI:1990; PR:On-going). The area involved in this project serves as occasional elk habitat. This project is not expected to contribute water related cumulative effects because no open water resources are located in the immediate vicinity of the project area.

(M105) Stillwater PGM. Exploration and evaluation. Helicopter-supported core drilling operations. Surface disturbance of less than 0.1 acre per year. (PD:1990-1998; NEPA:On-going per year submittal of plan of operations; PI:1990; PR:On-going). Areas adjacent to the project area serve as moderate to high use elk summer range. Helicopters used to support drilling operations have the potential to displace elk if coordination and timing restrictions are not stipulated in the plan of operations approval.

(M106) Chrome Corporation of America-Crescent Creek/Iron Mountain Project. Continued chrome ore exploration and evaluation. Ground disturbance will be approximately 0.1 acre per year or a total of 1 acre through the life of the project. (PD:1990-1997: NEPA:On-going per submittal of yearly plan of operations; PI:1990; PR:On-going). Areas adjacent to the project area serve as moderate to high use elk summer range. Helicopters used to support this project have the potential to displace elk if coordination and timing restriction are not stipulated in the plan of operations approval. This project represents small cumulative effect potential due to duration of the project.

Recreation

(M105) Stillwater PGM. Exploration and evaluation. Helicopter-supported core drilling operations. Surface disturbance of less than 0.1 acre per year. (PD:1990-1998; NEPA:On-going per year submittal of plan of operations; PI:1990; PR:On-going). This project has potential to impact wilderness users and day hikers within the West Fork of the Stillwater River drainage due to helicopter support of the program.

(M106) Chrome Corporation of America-Crescent Creek/Iron Mountain Project. Continued chrome ore exploration and evaluation. Ground disturbance will be approximately 0.1 acre per year, or a total of 1 acre through the life of the project. (PD:1990-1997: NEPA:On-going per submittal of yearly plan of operations; PI:1990; PR:On-going). This project has the potential to impact wilderness users and day hikers within the West Fork of the Stillwater River drainage due to helicopter support.

(Rc102) Road Access to Limestone Butte/Bad Canyon Area Road access is needed to tie in with the existing trail system at the south end of the management area. The preferred route would be north of Limestone Butte. This option may not be feasible. The second access option is in the Robinson Draw area. This option is more likely and would also allow for tie-in with the trails system. Trail construction is estimated at $15,000. (PD:1992-1994; NEPA:1993; PI:1993; PR:None) This project

will create additional recreational opportunities, thus preventing overuse or crowding in current recreational facilities or areas.

(Rc103) Johnson Draw Trail. Reconstruction of the Johnson Draw trail to provide loop opportunities for hikers, horse riders, and bicycles. This would not take place until Rc102 is accomplished and at an estimated price of $15,000. (PD:1993-1995; NEPA:1994; PI:1994; PR:None) This project is included for the same reason as Rc102.

(Rc104) Stillwater Overlook Development of a trail and overlook in the area of Old Nye Picnic area in 1993. This will create day-hiking opportunities and access to Horseman Flats Lake for fishing (Est. cost $15,000). (PD:1992-1994; NEPA:1992; PI:1993; PR:None) This project is included for the same reasons as Rc102, and Rc103.

(Rc105) Trailhead Parking at Lodgepole Road and Lodgepole/Dead Indian Creek Trails If public access is acquired on the Lodgepole Road, a trailhead parking facility will be needed at the junction of the Lodgepole Road and the Lodgepole and Dead Indian Creek trail systems. Access and trailhead facilities are targeted for 1993 at a cost of $10,000. (PD:1995-1997; NEPA:1996; PI:1996; PR:None) This project is included for the same reasons as Rc102, Rc103, and Rc104.

(Rc106) Trailhead and Washburn Trail Reconstruction Improvements to the road through Meyers Creek Station, development of a dispersed camping/trailhead facility, and reroute of the Washburn trail around the Washburn homestead. Target year to acquire the right of way and construct the trailhead is 1994. The estimated cost is $35,000. (PD:1994-1996; NEPA:1994-1995; PI:1997; PR:None) This project is included for the same reasons as Rc102, Rc103, Rc104 and Rc105.

(Rc107) Pass Creek Trail Locate the public access right of way through the private land and reroute the trail as needed for safety reasons. This will also involve reconstruction of the remainder of the trail. Estimated cost is $6000. (PD:1993-1997; NEPA:1993; PI:1997; PR:None) This project is evaluated for the same reasons as Rc102, Rc103, Rc104 and Rc105.

(Rc108) Initial Creek Campground The Initial Creek drainage does not allow for dispersed recreation opportunities due to the limited public land in the drainage. Use is currently concentrated at the end of the West Fork Stillwater River drainage. Plans are for construction of a 20-30 unit campground. The cost and estimated timeframe is unknown at this time. (PD:1997-1999; NEPA:1997; PI:1998; PR:1998-1999 if needed) This project is evaluated for the same reasons as stated in Rc102, Rc103, Rc104, Rc105, and Rc107.

(Rc109) Off Road Vehicle Area. Development of a trail system for both summer use (motorcycles) and winter use (snowmobiles) which will provide loop trails and trailhead parking. As preliminary planning has not yet begun, estimated development schedule is 1996 at an unknown cost. (PD:1994-1997; NEPA:1995; PI:1996-1997; PR: None) This project will create additional recreational opportunities, thus preventing overuse or crowding in current recreational facilities or areas.

(Rc110) Trailhead and Reroute of Benbow Trail #51. This is a popular access route to the Stillwater Plateau for hunting, fishing, and views of the Great Plains. This trail will also provide access to Mt.

Hague and Mt. Wood. Estimated construction will take place in 1996 at a cost of $20,000. (PD:1994-1996; NEPA:1995; PI:1996; PR:None). This project is evaluated for the same reasons as Rc102, Rc103, Rc104, Rc105, Rc107, and Rc108.

(Rc111) Woodbine Campground Reconstruction Planning is underway for the modernization and increased capacity of Woodbine Campground. Watershed concerns will be addressed in this project through the paving of roads and spurs. The estimated cost for the campground construction work is $210,000. Additional cost of road improvement and trailhead construction (ref. Rc112) is $350,000. This major project is planned for 1995. NOTE: The State plans to reconstruct FAS419 from FAP78 to the Stillwater Mine, and recreation use will significantly increase with a wide two-lane paved road providing access to the Woodbine area. (PD:1991-1996; NEPA:1992; PI:1995; PR:1996) This project would increase the quantity of recreational opportunities within the Stillwater River drainage.

(Rc112) Construction of Woodbine Falls Trail Trailhead. This is the second-most utilized "trail" on the Beartooth District. The trail has been developed through use and needs construction to improve the safety and grade. As it is a high-visibility site, we need a trailhead with parking facilities separate from the campground. Work is to be done in conjunction with the campground work in 1995. (PD:1991-1996; NEPA:1992; PI:1995; PR:None) This project would increase the quantity of recreational opportunities within the Stillwater River drainage.

Water Resources

(Nx 101) Noxious Weed Control. Continue to treat on an annual basis all known infestations of noxious weeds within the Stillwater IRA. (27 acres) (PD:1991-2000; NEPA:each project; PI:1991; PR:NA) Weed control measures may introduce chemicals into the groundwater. However, the agencies consider herbicides applied in accordance with the manufacturer's specification to be equivalent to Best Management Practices and will have minimal impacts on water resources.

(M101) Chrome Corporation of America Benbow Project. Continued chrome-ore exploration and evaluation that makes use of the access route from Dean to the Benbow Mine. Surface disturbance of 0.5 acre/year, or 2 acres total through duration of project. (PD:1990-1993; NEPA:1990; PI:1990; PR:1992-1993). This project is evaluated due to possible effects to water resources. Within the project area there are numerous streams, riparian areas, and springs.

(Rc109) Off Road Vehicle Area. Development of a trail system for both summer use (motorcycles) and winter use (snowmobiles) which will provide loop trails and trailhead parking. As preliminary planning has not yet begun, estimated development schedule is 1996 at an unknown cost. (PD:1994-1997; NEPA:1995; PI:1996-1997; PR: None) This project would take place in areas previously disturbed by past minerals exploration and development. Numerous small streams exist within the project area.

Socioeconomics

(Rc102) Road Access to Limestone Butte/Bad Canyon Area Road access is needed to tie in with the existing trail system at the south end of the management area. The preferred route would be north of

Limestone Butte. This option may not be feasible. The second access option is in the Robinson Draw area. This option is more likely and would also allow for tie-in with the trails system. Trail construction is estimated at $15,000. (PD:1992-1994; NEPA:1993; PI:1993; PR:None) Development of this road may increase the overall use in the area. Additionally, other resource values such as water and wildlife may be negatively affected due to implementation. However, development of this project may lessen the negative effects of overcrowding at currently-existing recreational areas or facilities.

(Rc103) Johnson Draw Trail. Reconstruction of the Johnson Draw trail to provide loop opportunities for hikers, horse riders, and bicycles. This would not take place until Rc102 is accomplished and at an estimated price of $15,000. (PD:1993-1995; NEPA:1994; PI:1994; PR:None) This project is included for the same reason as Rc102.

2.7.2 Projects of Concern Evaluated (GNF)

The following Projects of Concern listed within the GNF portion of the Stillwater IRA are evaluated for the purposes of cumulative-effects analysis. As previously stated, wildlife is the resource area which typically experiences the most noticeable impact due to cumulative effects. During the development of the East Boulder EIS, data collection and subsequent analysis indicated that the wildlife populations are expected to undergo very little adverse cumulative impacts due to the projected Reasonably Foreseeable Development forecast. Black bears were found to be an exception to this trend. Black bears apparently travel extensively between the East Boulder and the Stillwater River drainages (Stewart, personal communications). For the most part, wildlife which occurs on the GNF primarily utilizes habitat within the Boulder River drainage. The same wildlife habitat-use pattern is displayed within the Stillwater drainage.

The cumulative effects due to implementation of SMC's proposed action are sufficiently removed in both space and time from planned activities within the IRA analysis area of the GNF that no significant cumulative effects are expected. However, the following projects will be considered for the purpose of assessing cumulative effects.

Wildlife

The following is a summary of current minerals activity within the Stillwater Complex IRA area. These projects have potential for adverse cumulative impacts to recreation and wildlife. No adverse cumulative effects are expected in regards to water resources since all of these projects take place in the Boulder River drainage.

(M1) East Boulder Platinum, Palladium Mine Plan of Operations: EIS East Boulder. (PD 1990-2015, NEPA 1991, PI 1991, PR ongoing 1995-2015) This project is being considered in terms of potential socioeconomic impacts as well as potential wildlife (black bear) impacts. When this project comes on line, there will be increased numbers of persons living or working within the analysis area. Additionally, those lands which will be impacted by this project serve as important black bear habitat. The same local black bear population seems to utilize habitat and travel between the Boulder and Stillwater River drainages during the spring, summer, and fall.

(M2) SPGMR Exploration On-going helicopter and ground-supported exploration program. (PD 1989-1991, NEPA 1988, PI 1989, PR incorporated into M1) This project has the potential to impact black bear, elk, and mule deer which utilize habitat between the Boulder and Stillwater Drainages.

(M5) Pegasus Explorational Drilling Independence. (unknown at this time, assume drilling program sometime between 1990-1995 with associated NEPA and reclamation to follow). This project would occupy seasonally important black bear habitat. Additionally, elk utilize the area in summer and fall.

(M6) Pathfinder Explorational Drilling Independence. (unknown at this time, assume drilling program sometime between 1990-1995 with associated NEPA and reclamation to follow). This project would occupy seasonally important black bear habitat. Additionally, elk utilize the area in summer and fall.

Recreation

Recreationists apparently display the same use trends as wildlife in the project area. That is to say, people tend to utilize recreational opportunities within the area which they live. All the below-identified projects are expected to benefit the recreation resources in the analysis area. These projects are considered in the context of cumulative effects because it is expected that these recreational opportunities will be utilized by the increased mining-related population.

(Rc1) Campground reconstruction Redesign and reconstruct the East Boulder Campground. CE 1990. Cost: $29,000 CIP. Implement 1991.

(Rc2) Campground maintenance Provide heavy maintenance at West Boulder campground. Replace fire grates and picnic tables; improve vehicular access. Provide for handicapped access to restroom facilities. CE 1990. Cost: $15,000 CIP. Implementation 1991.

(Rc3) Trash dump and mining claim cleanup Inventory trash dumps and mining claims, especially in Placer Basin area. Clean up and pack out trash. Ongoing. No NEPA required.

(Rc4) High impact campsite restoration Provide restoration of high-impact campsites in the front and backcountry as needed. Some NEPA completed and ongoing. Cost: $25,000 in 1990. Excess timber sale receipt funding.

(Rc6) Picnic area construction Construct 2 small developed picnic areas.
One located off Iron Mountain Road and one in the Bridger Creeks. NEPA CE in 1990. Cost: $20,000. Implement 1992.

2.7.3 Projects of Concern Not Evaluated

The Stillwater IRA listed and considered 26 Projects of Concern for the purposes of cumulative-effects analysis on the Big Timber Ranger District. Nine of these have been considered for this project. Similarly, 31 Projects of Concern were listed and evaluated on the Beartooth Ranger District, 21 of these have been considered for the purposes of cumulative-effects analysis related to implementation of SMC's proposed action.

Projects of Concern not evaluated in this document do not contribute cumulative impacts within the project area due to the timing, administrative nature, or specific location of the proposed project. A description of these projects appear in Chapter 5 of the Stillwater IRA. This document is available to the reader upon request at either the CNF Supervisors Office, the Beartooth Ranger District, or the Big Timber Ranger District.

Two notable projects not evaluated in terms of cumulative effects for this proposed action are Chrome Corporation of America's (CCA) Mountain View project and International Platinum's (IP) Exploration program. Both of these projects were evaluated for possible cumulative effects in both the Stillwater Integrated Resource Analysis and the 1989 East Side Amendment EA/PER.

The rationale for not considering these projects for the purpose of cumulative effects assessment is that, at this time, neither project is reasonably foreseeable. During the summer of 1991, neither CCA nor IP filed Plans of Operations with the Beartooth Ranger District.

In the case of CCA, the market for chrome products is not favorable for profitable mining. This trend is not expected to be reversed in the foreseeable future. During 1991, CCA could not find a joint venture partner willing to share exploration cost at the Mountain View site. Therefore, the Beartooth District has directed CCA to implement final reclamation plans at the project site.

IP is no longer in business as a company conducting exploration projects. Therefore, the Beartooth Ranger District does not anticipate reactivation of a large-scale exploration program by this company.

Because SMC's ore body is over 20 miles long and in mining terms relatively unlimited, there is a possibility that a second tailing impoundment would be built. SMC would determine if it could economically recoup a $10 million to $20 million investment for a new impoundment, based upon anticipated metal prices, costs of ore extraction, operational costs, etc. Most of the economic criteria are variable, changing over time and by the site selected. If SMC decided to continue its operations, the company would be required to submit an application which would undergo full environmental analysis and disclosure under the NEPA/MEPA process.

The agencies presently have no indication that a new impoundment is reasonable or foreseeable. Also, the method of delivering tails, construction materials, such as waste rock or borrow, traffic generation patterns, and all site specific information is unknown. A new impoundment would probably disturb 100 to 150 acres and could be at any of the 17 alternative sites identified in the original EIS (DSL/FS, 1985) or at any other location. In other words, no meaningful analysis can be conducted at this time.

Table 2.5-2 Summary of Alternative Impacts

Issue	No-Action - Alternatives 1,3a and 4a	Company's Proposal - Alternatives 2, 3b, 4b	Partial Approval Alternative 3c	Modified Impoundment Alternative 3d	Advanced Treatment Alternative 4c	Company Proposal with Modifications Alternative 5
Tailing Impoundment Construction Section 4.1	Above factors of safety for mass failure; Impoundment size the same; 22 year capacity @ 1000 tpd; No waste rock surplus;	Approaching factors of safety for mass failure; Size increased 4 acres 17 year capacity @ 2000 tpd; 330,000 yd^3 waste rock surplus;	Above factors of safety for mass failure; Size remains the same; 12 year capacity @ 2000 tpd; No waste rock surplus	9 acres larger than present; Above factors of safety for mass failure; Size increased 9 acres; 17 year capacity @ 2000 tpd; 250,000 yd^3 waste rock deficit; must relocate FS 419;	Disposal of additional sludges and/or brines.	No impacts
Water Resources Section 4.2	Nondegradation does not apply MPDES permit renewed based on existing limitations; No surface water quality standard would be exceeded; Groundwater concentrations of ammonia, nitrate and dissolved chromium would increase slightly but would not exceed standards.	Nondegradation applies; Petition to change ambient water quality for total dissolved solids, ammonia, nitrates and metals in both surface and groundwater requires decision by the BHES; Numeric water quality standards would not be exceeded; Human health and aquatic organisms would not be negatively impacted if petition were granted.	Nondegradation applies; Petition to change ambient water quality for total dissolved solids, ammonia, nitrates and metals in both surface and groundwater requires decision by the BHES; Numeric water quality standards would not be exceeded; Human health and aquatic organisms would not be negatively impacted if petition were granted.	Nondegradation applies; Petition to change ambient water quality for total dissolved solids, ammonia, nitrates and metals in both surface and groundwater requires decision by the BHES; Numeric water quality standards would not be exceeded; Human health and aquatic organisms would not be negatively impacted if petition were granted.	Existing water quality conditions would be maintained; May require use of additional chemical reagents; Increased water withdrawals from the Stillwater River.	Nondegradation applies; Petition to change ambient water quality for total dissolved solids, ammonia, nitrates and metals in both surface and groundwater requires decision by the BHES; Numeric water quality standards would not be exceeded; Human health and aquatic organisms would not be negatively impacted if petition were granted.
Soils and Reclamation, including Tailing Impoundment Section 4.3	No increased disturbances; Marginal reclamation because of limited replacement soil; Long tailing embankment slopes increase erosion potential; Irrigating with nitrate increases plant growth;	About 35 acres of new disturbance; Marginal reclamation because of limited replacement soils; Rock armored embankment stops soil erosion but eliminates vegetative productivity on 42 acres; Irrigating with nitrate increases plant growth;	About 20 new acres of disturbance; Marginal reclamation because of limited replacement soils; Long embankment slopes increase soil erosion potential; Irrigating with nitrate increases plant growth;	About 30 new acres of disturbance; Marginal reclamation because of limited replacement soils; Lengthened embankment slope increases erosion potential; Irrigating with nitrate increases plant growth;	No impacts	Changed soil salvage standards increases replacement volumes; Review leads to identification of soil borrow areas to increase soil depths and reclamation potential; Mosaic pattern on embankment reduces erosion substantially;

Issue	No-Action - Alternativas 1,3a and 4a	Company's Proposal - Alternativas 2, 3b, 4b	Partial Approval Alternativa 3c	Modified Impoundmant Alternativa 3d	Advancad Treatment Altarnativa 4c	Company Proposal with Modifications Altarnative 5
Wildlife Section 4.4	Bighorn shaap herd continues to ba threatanad; Major winter forage on toe dike remains; Futura reclaimed embankmant might ba foragad by bighorns;	Bighorn shaep hard continuas to be thraatened; Rock armor eliminates forage on toe dika and potential on raclaimad ambankmant;	Bighorn sheap hard continuas to ba thraatanad; Reclaimad embankment might ba foraged by bighorns; Toa dika foraga remains;	Bighorn sheep herd continues to ba thraatenad; Reclaimad embankmant might ba foragad by bighorns but toa dika lost; Lengthanad embankment might produce lass forage than prasant plan bacause of erosion;	Addad disturbanca araa dacreases habitat dasirability;	Mosaic reclamation anhances desirability by increasing divarsity and productivity;
Air Quality Section 4.5	No impacts	Soma increasa in amissions due to incraasad production	Soma incraase in emissions dua to increasad production	Some incraase in emissions due to increased production	Some incraasa in emissions dua to incraased production	Some increase in emissions due to incraased production
Land Use Section 4.6	No impacts	Racraational usa would incraasa soma	Recraational use would incraasa some	Recreational use would incraasa some	Racreational use would incraase some	Racreational usa would incraase some
Aesthatics Saction 4.7	Visually uniform vagetation; Dam height unchangad; Moderata time to achiava ratention of visual quality; No visual scraaning;	Visually uniform rock armor; Dam haight raisad 14 ft; Longer time after closing to achiava ratantion of visual quality, but shortar impoundmant life; Visual scraaning barm on east side;	Visually uniform vegetation; Dam haight unchanged; Modarate time after closing to achiave ratention of visual quality but shortest impoundmant lifa; No waste rock available for east sida visual screening barm;	Visually uniform vagetation; Dam height raised 15 feat; Moderate time after closing to achieve retention of visual quality, but shorter impoundmant life; No wasta rock availabla for visual screaning barm;	Could hava visual impact during operations;	Most varied visually; Dam height could be raisad 15 ft; Shortast tima to achieve retention of visual quality dua to mitigation and shorter impoundmant life; Probably no wasta rock available for visual scraaning berm;
Socioeconomics/Traffic Section 4.8	Population will grow 800 by year 2000; Housing will remain tight; Some school, sawer and water servicas will axcaad capacity in Columbus and Absarokaa; Traffic problams will reduca slightly dua to road upgradas;	Total amployment impact of 232 jobs; County population increase of 150 ovar projactions; Impacts on housing and community sarvicas and facilitias more savere; Traffic doubled to about 262 cars per day;	Total amploymant impact of 232 jobs; County population increasa of 150 ovar projections; Impacts on housing and community sarvicas and facilities mora sevare; Traffic doubled to about 262 cars per day;	Total amployment impact of 232 jobs; County population increase of 150 over projections; Impacts on housing and community servicas and facilitias mora severe; Traffic doubled to about 262 cars per day;	Total amploy-mant impact of 232 jobs; County popula-tion incraase of 150 ovar projec-tions; Impacts on housing and community services and facilities more savare; Traffic doubled to about 262 cars par day;	Total amploymant impact of 232 jobs; County population incraase of 150 over projections; Impacts on housing and community servicas and facilitias mora severa; Traffic incraased by about 25 cars par day;

CHAPTER 3 - AFFECTED ENVIRONMENT

3.0 Introduction

An analysis of the potential environmental impacts of SMC's proposed 2,000-tpd expansion within the Stillwater River Valley necessitates an understanding of the current status of that environment. To facilitate this understanding, a review of current conditions has been conducted to address various environmental resources or disciplines. Together these topics encompass the social, economic, and natural settings which are part of the "affected environment" for this project. The material described has been guided by public issues identified through the scoping process and interdisciplinary field analysis.

The location of the activities included in the proposed amendment to the current plan of operations is in the upper reaches of the Stillwater River Valley approximately 5 miles southwest of Nye, Montana. The surrounding area is mountainous, relatively sparsely populated, and noted for its scenic beauty and recreational opportunities such as hunting, hiking, fishing, and camping. The Absaroka-Beartooth Wilderness lies approximately 1.5 miles to the south of the project area; additionally, Yellowstone National Park lies approximately 25 miles to the south.

An important function of this environmental document is to evaluate alternatives developed to reduce or eliminate degradation of groundwater and surface waters in the vicinity of the mine. Montana groundwater pollution control for mining projects occurs through conditions contained in the operating permit. Discharges to groundwater and surface waters for this project would contain ammonia, nitrate and some metals at concentrations greater than the existing water quality. Under Montana's nondegradation rules, SMC has submitted a Petition for Modification of Ambient Water (SMC, 1991a and 1992) to the BHES. This EIS will provide the analysis required by the BHES to make an informed decision whether to grant the exception or to require implementation of methods designed to prevent water degradation.

This section of the document describes only those parts of the environment that could be affected directly or indirectly by the proposed action. For the sake of brevity, those portions of the environment that will not be impacted by this project have not been discussed.

This section is tiered to both the original EIS (1985) for the Stillwater Project and the East Side EA/PER (1989).

3.1 Geology

The platinum group metals (PGM) that SMC extracts are found in the Stillwater Complex, a 1- to 5-mile-thick by 28-mile-long geologic formation consisting of layers of iron and magnesium-rich, generally dark-colored, igneous rocks. The platinum and palladium rich ore zone called the J-M Reef averages four feet in width and is located near the bottom of the tilted complex above the chromite-rich zones. The J-M Reef and some of the chromite beds can be traced for the full length of the exposed complex. The depth of these features is not known, but geophysical studies and outcrops of similar rocks to the north suggest that they could continue for several miles.

The Stillwater Complex also contains concentrations of chrome, copper, nickel, and iron minerals which have periodically drawn the interest of a variety of mining companies. Generally, the concentrations of these elements is not high enough to warrant commercial development considering current prices and technology, but the resources are significant and may be important for national security reasons. Chrome was mined during the two world wars from the Benbow and Mouat mines in the Stillwater River valley, and the Gish Mine in Main Boulder River valley until the Department of Defense was able to secure the sea lanes to ensure the supply from South Africa, which remains our major source of chrome.

For complete details of the Stillwater Complex please read "Stillwater Complex, Special Publication 92," by the Montana Bureau of Mines and Geology, 1985. The Stillwater EIS (DSL/FS, 1985) also contains a thorough discussion.

3.1.1 Geotechnical

Subsidence

As discussed in the 1985 EIS written for the initial permit (Chapter IV, pages 2-3), crown pillar failure above underground workings could result in surface subsidence. With the advance of mining into crown pillars, high extraction ratios and subsequent mining-induced stress increases cause inequilibrium and resulting fracturing within the surrounding rock mass. Destressing through microfracturing can occur extensively into the rock mass surrounding underground openings and, in the proposed 50-foot crown pillars, destress fractures can be expected to intersect fractured, weathered rock that occurs naturally near the surface.

The degree of surface expression of subsidence is dependent on the load-bearing strength of the rock and the geometry and extent of mined areas. Convergence, or the tendency of underground openings to close over time as equilibrium is reestablished, is the physical cause of surface subsidence; convergence can be controlled and reduced by remnant sill and rib pillars within the mining plane, and to a limited extent by backfilled mine openings. Since provided information indicates that ore grade material is not consistent throughout the plane of the deposit, it is anticipated that adequate pillars will remain in place and substantially limit convergence. Further, backfilled stopes minimize the void available for failed crown pillar materials to fall into, and the tendency of fractured rock to swell relative to the in-place volume would choke off caving and prohibit mass subsidence.

Surface subsidence is expected to occur in areas where stoping advances to within 50 feet of the surface; however the extent of subsidence would likely not be visible to a casual observer and may only be detectable by instrumentation. The geomorphic effects of surface subsidence should be stable and inconsequential, though fractured crown pillars would create conduits for surface water recharge of groundwater flows.

Fractured crown pillars and minimal subsidence above backfilled voids results in a cone of depression and drawdown point for area groundwater. Groundwater flows increase through the pervious sandfill and mine openings, and corresponding recharge from surface flows causes a

permanent change in the area groundwater and surface water systems. In areas where the fractured crown pillars intersect snowmelt saturation zones or are crossed by drainage courses, surface water transition to the altered groundwater system can involve significant volumes.

Seismicity

The project area is characterized as an area of low to moderate seismicity. Within historical times only one earthquake with a magnitude greater than 7.0 on the Richter scale has occurred within a 100-mile radius of the site. This earthquake in 1959 had its epicenter 72 miles southwest of the project area in the vicinity of Hebgen Lake. The quake, measuring 7.1, caused minor damage and generated several rock falls within the Stillwater drainage (see also Stillwater Project EIS, Chapter III, pages 6-8).

The nearest fault known to be active in the area is the Emigrant Fault located in the Yellowstone River Valley, about 32 miles to the west. This fault has the potential to generate a large earthquake of up to 7.0. The tailing impoundment permitted for the original mine was constructed to withstand earth tremors of this magnitude.

Localized faulting is not believed to have the strike length or displacement of the active fault systems that were analyzed by SMC. It is improbable that movement along the local fault zones would generate ground vibration at the site that would exceed the average particle acceleration of 10 percent of gravity that has been used in the analyses. Peak particle accelerations of short duration may exceed the average particle acceleration used in the stability analyses, but are not considered to be as structurally damaging as sustained (or average) particle movement. Published information (Hunt, 1984) indicates that the project area has a 90 percent probability of not exceeding a peak particle acceleration of 20 percent of gravity in 50 years. Therefore, the selected seismic coefficient of an average particle acceleration of 10 percent of gravity is considered to be reasonable.

The dam itself is not subject to liquefaction by ground vibration, partly because it is constructed of material with a graded particle size distribution that is not conducive to pore pressure increases during vibration, but more importantly because the pond is lined and the dam and foundation are not designed to pass seepage (unlike water retention structures).

Failure of the dam by displacement would not be expected to have catastrophic consequences. Failure of the dam by displacement may result in the facility being structurally unsound for future use. Some ponded water could be released by total displacement failure of the dam, but the tailing mass would not be expected to flow.

Potential Geologic Hazards

The roads and adits in the permit area are constructed on Pleistocene landslide and glacial deposits up to 400 feet thick. This material was deposited under glacial conditions totally different from those which exist today and have been stable for thousands of years. These old deposits pose no threat of reactivation during the life of the mine. There is always a possibility of rock fall and small scale landslides within the Stillwater Valley and precautions have been taken for the adits constructed

below potential slide areas to protect portals (see also the Stillwater Project EIS, Chapter III, pages 8-10).

Numerous avalanche tracks occur near the mine site. However, the permit area does not include any avalanche corridors.

3.2 Water Resources

3.2.1 Surface Water

Surface water features near the Stillwater Mine are dominated by the Stillwater River. The Stillwater River flows within one-quarter mile of the mine. All water that flows from the mine area drains into the Stillwater River. Most other drainages within the southeastern portion of the Beartooth Mountains also flow into the Stillwater River.

Flows in the river usually peak during June or July from snowmelt and increased spring precipitation. Roughly three-fourths of the annual runoff occurs in May, June, and July. Streamflows in the Stillwater River have been measured since 1979 by the USGS at a stream gaging station located at the bridge above Nye Creek near the Stillwater Valley Ranch percolation ponds. Annual mean flow in the Stillwater River is 367 cfs (cubic feet per second). The highest monthly mean flow (1758 cfs) occurs in June and the lowest monthly mean flow (50.7 cfs) occurs in March. The 7-day, 10-year low flow for the Stillwater River at the USGS gaging station is estimated to be 31.1 cfs. The maximum peak flow recorded was 6,400 cubic feet per second (cfs); the lowest flow recorded was 16 cfs, or less than 1 percent of the maximum flow. The upper Stillwater basin has a high variation in average annual precipitation rate (20 to 40 inches per year) and rough topography (maximum relief is 6,400 feet), which account for the wide range in water flows and high spring runoff.

Several small tributaries flow into the Stillwater River in the mine project area and are considered sub-alpine streams. These streams are, Verdigris Creek, Nye Creek, and Mountain View Creek.

Surface water quality within the Stillwater River Basin is generally good to excellent, reflecting the undeveloped state of the area. The Stillwater River is classified as a B-1 type by DHES, meaning the water is generally suitable after conventional water treatment for drinking, cooking, and food processing. The water may be used without further treatment for bathing; swimming; recreation; growth and propagation of trout fisheries and associated aquatic life, water fowl and furbearers; and agricultural and industrial supply.

Baseline and on-going operational monitoring has been conducted by SMC at the mine site since 1980. This data is supplemented by occasional monitoring by the agencies. Monitoring locations are depicted in Figure 3.2-1. The Stillwater River is monitored upstream (SMC-1A) and downstream (SMC-2 and SMC-10) of the mine. Prior to the construction and utilization of the Stillwater Valley Ranch percolation ponds (Amendment 7), SMC-2 was used as the downstream monitoring site. SMC-10 was added as part of Amendment 7 to monitor the impacts of the percolation ponds and does not have as extensive a period of record as the other sites. Results from

510,000 N
508,000 N
506,000 N
504,000 N
1,900,000 E
1,902,000 E
1,904,000 E
1,906,000 E
1,908,000 E
1,910,000 E
SMC-10
U.S.G.S Gaging Station
Fish Ponds
MW-13A
MW-13
STILLWATER RANCH
STILLWATER VALLEY
SMC-70
MW-12A
Nye Creek Diversion
Percolation Ponds
MW-14A
Existing Operating Permit Boundary
SMC-2
T-2A
SMC-7
SMC-8
MW-9
T-2
Downwind Air Quality Station
SMC-4
Mine Water Emergency Overflow Pond
MW-11
Mine Water Holding Tank
Emergency Spill Pond
Existing Percolation Ponds
EAST SIDE CLARIFIER (SMC-9)
EAST SIDE SPRING (SP-3)
SMC-7C
SMC-7B
Stage 4 Final Tailing Elevation 5102
MW-7A
MW-7B
& MW-7C
T-1A
MW-6A
SOUTHEAST SPRING
SMC-7A
Existing Operating Permit Boundary
WEST SIDE CLARIFIER
SMC-3
MW-5A
SMC-5
MW-10A
SMC-6
Water Supply Production Well
SMC-1A
Upwind Air Quality Station
MOUAT NICKEL CAMP
NORTH
BUFFALO JUMP SPRING
SP-2
UPPER JONES SPRING
SP-1
Additional Spring Location Map
LEGEND
Surface Water Monitoring Site
Groundwater Monitoring Site
Spring Location
SCALE
400' 0 400' 800' 1200 feet
HYD-786-88

Stillwater Mining Company

Drawn: JMD
Checked: ORS
Approved: DCP
Date: 3/21/91

Water Resources Monitoring Sites
Figure 3.2-1

EXHIBIT

Hydrometrics, Inc.
Consulting Scientists and Engineers
Helena, Montana

the SMC operational monitoring program for the Stillwater River, Mountain View and Nye Creek are summarized in Table 3.2-1[1].

The Stillwater River is low in total dissolved solids (TDS), has near neutral pH, and has generally low metals concentrations. Concentrations of dissolved solids are generally lowest during seasonal high flows and increase during the low flows in late fall and winter. TDS ranged from 18 mg/L on May 25, 1988 at SMC-2 to 98 mg/L at SMC-10 on November 21, 1991. TDS for the two tributaries are on average higher than the Stillwater but demonstrate similar annual variation.

Monitoring of nitrates at SMC-1A (upstream) and SMC-2 (downstream) indicates no significant difference [2] between these two locations. Since the Stillwater River is a losing stream throughout this section, increases would not be expected. Due to the limited number of samples at SMC-10, statistical comparisons are not appropriate; however, the data available indicate similar results.

Although the concentration of nitrates has not increased at the downstream sites, nitrates have increased in concentration at all locations, including the upstream site, since May 1989 (Figure 3.2-2). The source of these elevated nitrates is not readily apparent. Many streams in Montana demonstrated elevated nitrogen concentrations as a result of the 1988 fire season. Approximately 23 percent, or 31,700 acres, of the Stillwater watershed burned during this period. No other major sources of nitrogen are known.

Cadmium, chromium, copper, iron, and zinc are occasionally found at detectable concentrations at most of the monitored sites (Table 3.2-1). Aluminum (<0.030 to .300 mg/L), manganese (<0.001 to 0.010 mg/L), and strontium (0.020 to 0.050 mg/L) are also common in the Stillwater drainage (Feltis and Litke, 1987). Surface water samples are analyzed as Total Recoverable (unfiltered and field acidified) which includes the particulate material in the sample. Metals are generally associated with this particulate material and are not found at detectable amounts in the dissolved state.

Because of the concern for nondegradation, supplemental analyses for additional parameters and utilizing lower detection limits than used in routine monitoring were performed by SMC. These analyses indicate that arsenic, antimony, beryllium, mercury, selenium, silver, and thallium do not occur at detectable levels.

With the exception of cadmium and lead in the Stillwater River and possibly chromium in Mountain View Creek all metals are less than freshwater chronic or human health criteria. The

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[1]In calculating mean (average) concentrations, and in other numerical calculations for metal analyses, the analytical detection limit was used for values that were reported as being below detection limit. Only when all observations are below detection limits is the value reported as below detection limit ("<"). This procedure introduces a bias into arithmetic averages and other numeric calculations. Therefore, the detection limit and number of analyses using that detection limit are also reported to give the reader a point of reference to evaluate the reliability of the reported value.

[2]Paired T-test; non-significant at the 95 percent level

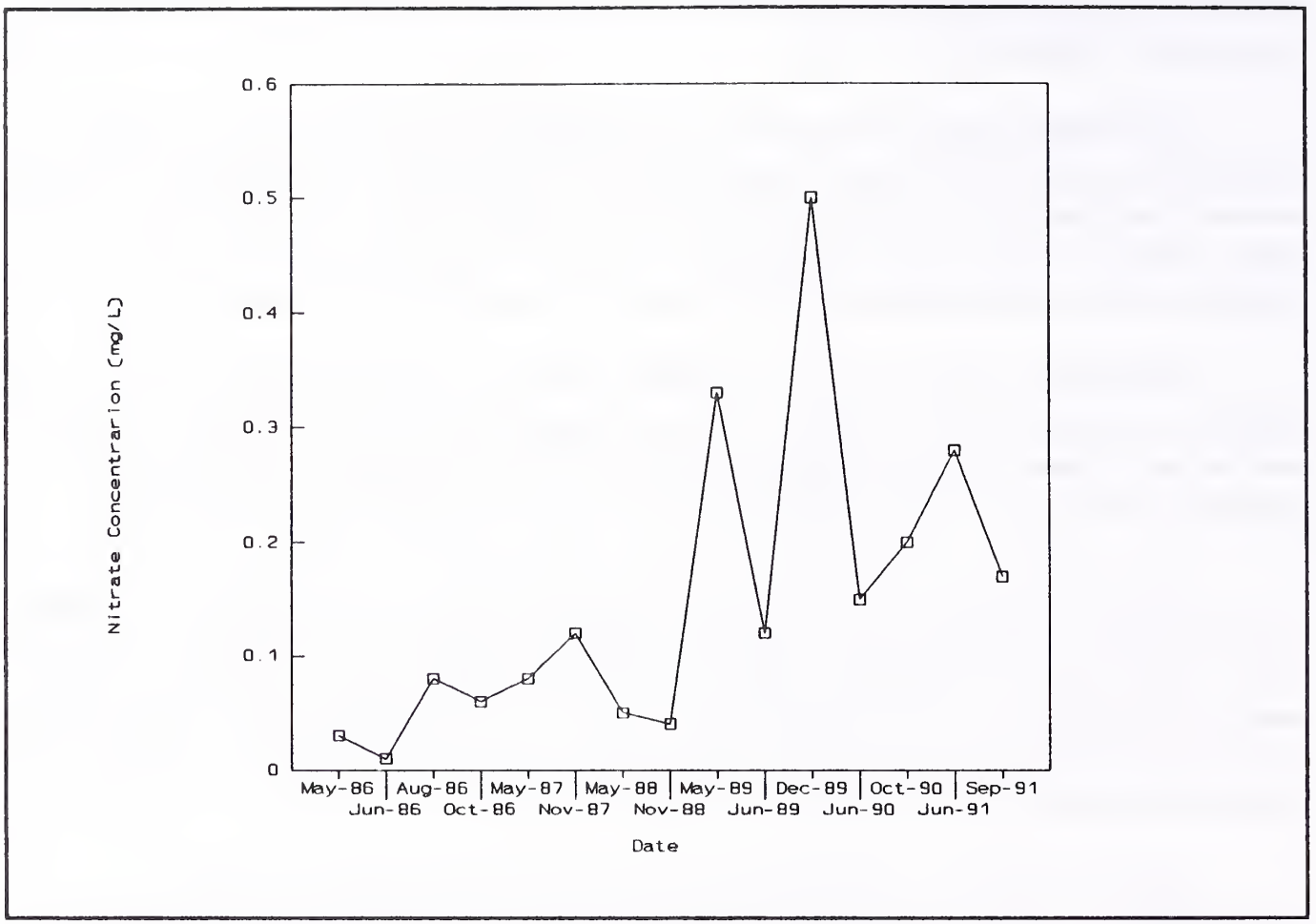

Figure 3.2-2 Nitrate concentration at SMC-1A, upstream of the SMC Mine

freshwater criteria are 0.0003 mg/L for cadmium and 0.0004 mg/L for lead at a hardness of 20 mg/L (as $CaCO_3$). The freshwater criteria for hexavalent chromium are 0.011 mg/L and 0.055 mg/L for trivalent chromium. The analytical method utilized measures total chromium and since trivalent is much more common, it is likely that the standards for chromium are not being exceeded.

Iron, copper, and nickel sulfides, as well as chromite (Cr_2O_4) are well documented in the Stillwater Complex and would reasonably be expected to be elevated in this area. Other metals of concern, such as lead, cadmium, mercury and zinc are present in localized zones. The low solubility of these metals limits their concentration and they are usually only found in association with particulate material. Mining increases the concentration of metals in water that contacts mine workings. The chromium in Mountain View Creek is a result of an abandoned adit above the SMC permit boundary. No evidence indicates that SMC's present mining operations have increased the concentrations of metals in surface waters.

3.2.2 Groundwater

There are two major aquifers present in the Stillwater Valley near the mine site. These are the unconsolidated alluvium/alluvial fan deposits of the Stillwater Valley and the fractured bedrock system.

Bedrock lies on both sides of the Stillwater River and beneath the surficial deposits that occupy the valley. Groundwater in the bedrock is mainly confined to openings such as joints, faults, and shear zones.

Recharge of the bedrock groundwater system probably occurs mostly at higher elevations, where snowmelt and rain infiltrate and percolate along joints, fractures, and bedrock discontinuities.

Groundwater leaves the bedrock as (1) surface springs and (2) discharge to unconsolidated subsurface materials low in the valleys and draws of the region. Groundwater discharge from bedrock most likely contributes significantly to alluvial groundwater and possibly surface water systems of the Stillwater River. Seasonal variation in the volume of bedrock discharge, along with infiltrated surface runoff from snowmelt, contributes to the perennial character of the Stillwater River (SMC, 1984a). Wells drilled in the bedrock generally produce very little water and the system is generally not used as a water supply.

The alluvium along the Stillwater River is the major source of groundwater in the valley. The general flow direction for the Stillwater River alluvial groundwater is downstream, or from the south and west to the north and east (Figure 3.2-3). Water level elevation data from monitoring wells show that groundwater flows from the alluvial fan deposits on the valley sides towards the Stillwater River. Some stream reaches are gaining sections, while others are losing sections. The configuration of the potentiometric surface on Figure 3.2-3 and water levels observed in nested monitoring wells MW-7A, B and C indicate a losing stream reach above the Stillwater Valley Ranch. Downstream of the Stillwater Valley Ranch, groundwater probably recharges the Stillwater River. The Stillwater alluvium has excellent water-yielding capability and is capable of supplying several hundred gallons per minute to wells on a sustained basis. At least 17 wells are known to produce water from the alluvial deposits in the upper Stillwater River Valley. Based on available aquifer testing data, the hydraulic conductivity of the unconsolidated sediments ranges from 0.0004 to 0.07 centimeters/second with an average hydraulic conductivity (coefficient that describes the rate at which water can move through a permeable material under standard conditions) of 0.025 centimeters/second. Groundwater is also present in the alluvial fan deposits on the lower valley wells. Three domestic wells (LW, HW, RW) located north of the mine site tap this source of groundwater (Figure 3.2-3).

In addition to the alluvial deposits, an area on the east side of the river near the mine site contains an additional unconsolidated deposit composed of old tailings from the previous Anaconda Chrome Mine. Three observation wells were completed in the alluvial deposits underlying the chrome tailings (T-1A, T-2, T-3A) and have been used to collect both flow and water-quality parameters.

Eight monitoring wells are installed on the west side of the Stillwater River, three on the east side and four wells are installed in the vicinity of the Stillwater Valley Ranch (SVR) percolation ponds (Figure 3.2-1). SMC currently disposes of approximately 500 gpm of excess adit water through land application (flood and spray irrigation) during the growing season (approximately 6 months) and through percolation ponds located at the SVR during the remainder of the year. Other percolation ponds are used intermittently to hold excess water encountered during drilling, for maintenance and during power failures. During the growing season approximately 40 percent of the water is land

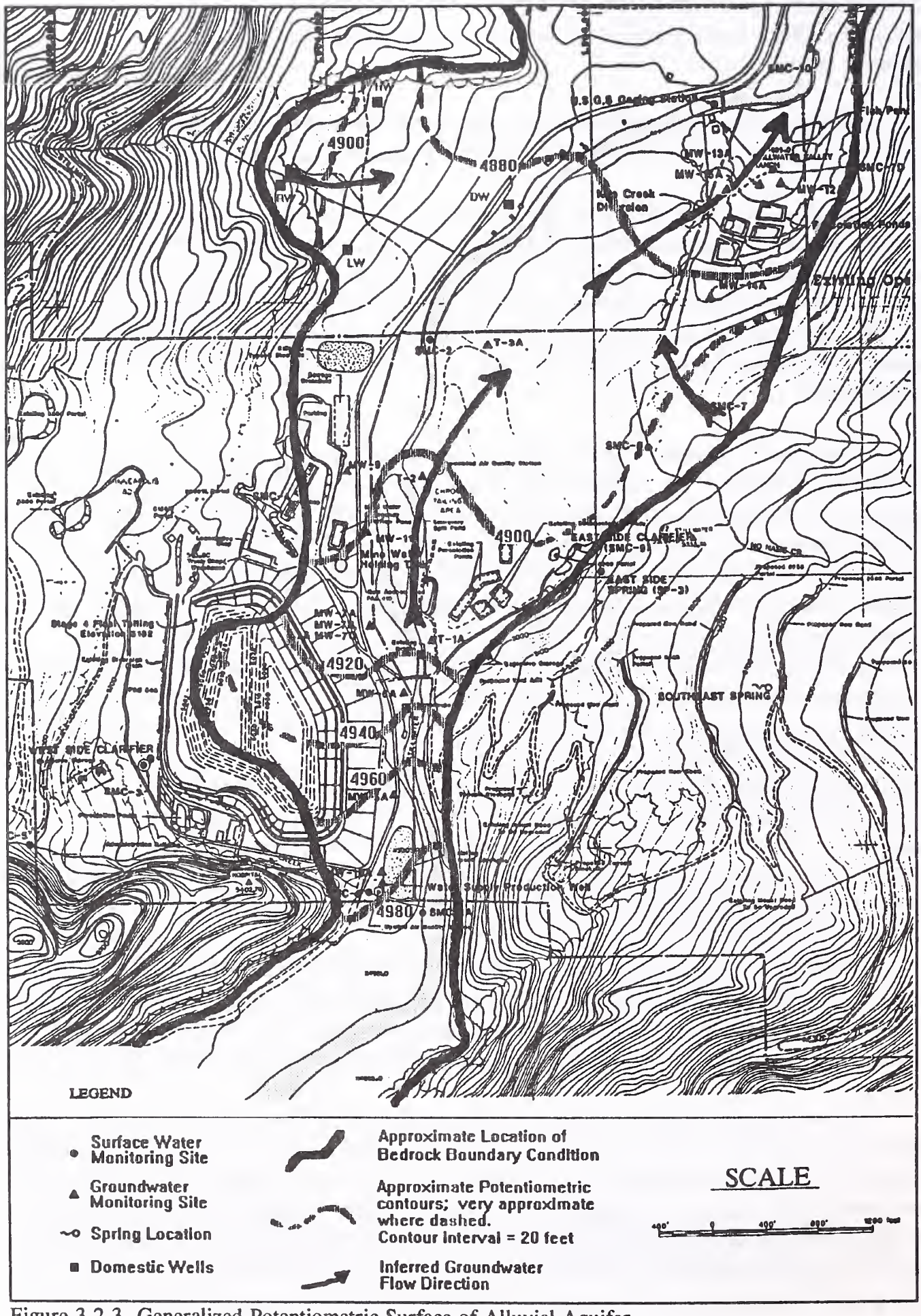

Figure 3.2-3 Generalized Potentiometric Surface of Alluvial Aquifer

Table 3.2-1 Mean Surface Water Concentrations for Stillwater River (SMC-1A, 2 and 10), Nye Creek (SMC-7) and Mountain View Creek (SMC-6)

	Location				
Parameter	SMC-1A	SMC-2	SMC-10	SMC-7	SMC-6
Begin Date	May 1986	May 1986	November 1990	May 1988	March 1987
End Date	June 1991	June 1991	June 1991	January 1991	January 1991
Sample Size	17	17	4	8	11
pH (Standard Units)	6.7	6.8	7.1	7.6	7.8
Specific Conductance (μmhos/cm)	50	50	82	121	231
Total Dissolved Solids (mg/L)	31	32	52	73	133
Major Cations (mg/L)					
Calcium	5	5	9	10	18
Magnesium	2	2	4	9	19
Sodium	1	1	2	2	4
Potassium	<1	<1	1	<1	<1
Major Anions (mg/L)					
Bicarbonate	22	22	43	71	144
Sulfate	5	6	8	6	9
Chloride	1	1	1	1	2
Hardness	21	20	39	61	123
Nutrients (mg/L)					
NO_2 + NO_3	0.16	0.18	0.29	0.06	0.19
Ammonia	<0.1	<0.1	<0.1	<0.1	<0.1
Kjeldahl Nitrogen	0.2	0.5	0.5	0.1	0.1
Total Phosphorus	0.02	0.07	0.01	0.01	0.01
Total Recoverable Metals* (mg/L)					
Cadmium (0.001)	0.002 (8)	0.003 (8)	<0.001 (4)	0.001 (6)	<0.001 (6)
Chromium (0.02)	<0.02 (16)	<0.02 (16)	<0.02 (3)	<0.02 (8)	0.04 (11)
Copper (0.01)	0.01 (15)	0.01 (16)	<0.01 (4)	<0.01 (8)	<0.01 (11)
Iron (0.01)	0.26 (4)	0.09 (4)	0.11 (2)		
Lead (0.01)	0.01 (16)	<0.01 (11)	0.01 (3)	<0.01 (6)	<0.01 (6)
Manganese (0.02)	<0.02 (5)	<0.02 (5)	<0.02 (2)		
Nickel (0.03)	<0.03 (15)	<0.03 (11)	<0.03 (3)	<0.03 (8)	<0.08 (5)
Zinc (0.01)	0.01 (17)	0.01 (16)	0.01 (4)	0.01 (8)	0.01 (11)

Source: SMC, 1991b

*Parentheses indicate detection limit and number of samples at the reported detection limit. See footnote on page 71

applied to the west side and the remainder applied on the east side (Jim Richter, personal communication, 1991a).

Groundwater samples from the west side monitoring wells show the water is generally of good quality (Table 3.2-2). Area groundwater is classified as Class 1 (ARM 16.20.1002). This classification means groundwater is generally suitable for all beneficial uses with little or no treatment. Groundwater is a calcium bicarbonate or calcium-magnesium bicarbonate type. Total dissolved solids (TDS), sulfate, and nitrate concentrations generally increase in a downgradient direction. Metals are measured as dissolved (field filtered and acidified). Chromium, zinc and to a lesser extent cadmium are elevated in the downgradient wells (MW-11 and MW-9) relative to the upgradient well (MW-10).

Table 3.2-2 Mean Groundwater Concentrations - Selected West Side Monitoring Wells

	Location		
Parameter	MW-10	MW-11	MW-9
Begin Date	March 1987	March 1987	March 1987
End Date	December 1990	December 1990	December 1990
Number of Samples	14	15	14
pH (Standard Units)	7.2	7.4	7.3
Specific Conductance (μmhos/cm)	135	301	246
Total Dissolved Solids (mg/L)	84	179	149
Major Cations (mg/L)			
Calcium	11	22	19
Magnesium	8	21	18
Sodium	5	8	7
Potassium	2	2	2
Major Anions (mg/L)			
Bicarbonate	71	133	121
Sulfate	10	35	24
Chloride	3	6	5
Hardness	62	146	121
Nutrients (mg/L)			
NO_2 + NO_3	0.22	2.13	1.13
Ammonia	0.1	<0.1	0.1
Kjeldahl Nitrogen	0.1	0.2	0.1
Total Phosphorus			
Dissolved Metals* (mg/L)			
Cadmium (0.001)	<0.001 (7)	<0.001 (7)	0.001 (7)
Chromium (0.02)	<0.02 ( )	0.04	0.03
Copper (0.01)	<0.01 ( )	<0.01	<0.01
Lead (0.01)	<0.01 (7)	<0.01 (7)	<0.01 (7)
Nickel (0.03)	<0.03 ( )	<0.03	<0.03
Zinc (0.01)	0.01 ( )	0.02	0.03

Source: SMC, 1991b

* Parentheses indicates detection limit and number of samples at the reported detection limit. See footnote on page 71.

Increasing levels of TDS, sulfate, nitrate and to a lesser extent, chromium and zinc, reflect the current practice of disposing of excess adit water through land application and percolation. Data from 1980-83 in the same vicinity (MW-5,6,7 & 8) indicate TDS concentrations of 95 to 183 mg/L, sulfate concentrations of 10 to 14 mg/L, and nitrate concentrations of 0.11 to 0.35 mg/L (SMC, 1984). Zinc concentrations appear to have decreased from a range of 0.02 to 0.26 mg/L to the current levels, and chromium remains within the range originally observed, from <0.02 to 0.05 mg/L.

The primary impact to groundwater on the west side of the Stillwater River is in the vicinity of MW-11. Substantial dilution occurs between MW-11 and MW-9, approximately 400 feet away. This dilution is probably a result of mixing with the groundwater and dilution from the Stillwater River. Average static water levels in the vicinity indicate that the Stillwater River is a losing stream in this section. Dilution probably continues to occur and concentrations of these parameters may be lower at the SMC permit boundary 1,000 feet downgradient. However, the lack of additional monitoring wells and the possible interference effects of the sewage drainfield precludes accurate assessment of off-site impacts.

The nearest downgradient beneficial use is a domestic well (DW) located in the alluvial aquifer approximately 1,000 feet below the SMC permit boundary. Chemical data collected by SMC on this well indicated it is largely influenced by the Stillwater River and is not impacted by SMC operations. The concentration of TDS is 54 mg/L, sulfate is 10 mg/L and nitrate is 0.28 mg/L based on the average of two samples taken in 1989 and 1990 (SMC, 1991c). Moreover, the calcium to magnesium ratio indicates the source of this water is from surface water (2:1) and not groundwater (1:1). Cadmium, chromium, copper, lead and nickel were all below the analytical detection limit. Zinc was measured at the detection limit (0.01 mg/L).

Groundwater quality on the east side in the vicinity of the old chrome tailing are monitored with three monitoring wells (Table 3.2-3). Water quality is generally good and with increased concentrations of TDS, sulfate and nitrate similar to those observed on the west side. TDS and nitrate concentrations for the most recent period (1990-91) are 180 and 3.24 mg/L, respectively, compared to 46 and 0.18 mg/L, respectively, prior to land application. Despite the old chrome tailings in this vicinity metal concentrations are at or below detection limits and show no increase in concentration.

In the fall of 1990 SMC constructed four additional percolation ponds on the Stillwater Valley Ranch (SVR) (Amendment No. 007) to dispose of excess adit water during periods of the year when irrigation is not possible. These ponds were constructed in alluvial materials (interbedded gravel, sand and cobble) approximately 600 feet from the Stillwater River. Four additional monitoring wells were installed at this time. MW-14A was intended to be an upgradient control and MW-12A, MW-13A and MW-15A were installed as downgradient monitoring wells.

All adit discharge between March 1991 and May 1991 was directed to the SVR percolation ponds. Monitoring results for these wells before and after percolation are summarized in Table 3.2-4. Based on the TDS, sulfate and nitrate concentrations in MW-14A it is likely that this well is influenced by land application in the area to the south and west. TDS, sulfate and nitrate concentrations (average 254, 76 and 4.95 mg/L, respectively) in MW-12A and MW-13A increased much more than MW-15A (104, 13 and 0.053 mg/L, respectively) after percolation.

Table 3.2-3 Mean Groundwater Concentrations - East Side Monitoring Wells

Parameter	Location T-1A	T-2	T-3A
Begin Date	March 1988	March 1988	March 1988
End Date	January 1991	January 1991	January 1991
Number of Samples	9	9	9
pH (Standard Units)	7.4	7.0	7.1
Specific Conductance (μmhos/cm)	141	98	238
Total Dissolved Solids (mg/L)	81	55	141
Major Cations (mg/L)			
Calcium	11	8	20
Magnesium	10	5	17
Sodium	3	2	7
Potassium	1	<1	2
Major Anions (mg/L)			
Bicarbonate	80	44	111
Sulfate	7	7	34
Chloride	2	2	2
Hardness	68	45	114
Nutrients (mg/L)			
NO_2 + NO_3	0.32	0.43	1.82
Ammonia	<0.1	<0.1	0.1
Kjeldahl Nitrogen	0.1	0.1	0.36
Dissolved Metals* (mg/L)			
Cadmium (0.001)	<0.001 (7)	0.001 (7)	0.001 (7)
Chromium (0.02)	<0.02 (8)	0.02	<0.02
Copper (0.01)	<0.01	<0.01	<0.01
Lead (0.01)	<0.01	<0.01 (8)	<0.01 (7)
Nickel (0.03)	<0.03	<0.03 (8)	<0.03 (7)
Zinc (0.01)	0.01	0.01	0.02

Source: SMC, 1991b

* Parentheses indicates detection limit and number of samples at the reported detection limit. See footnote on page 71.

Metal concentrations are at, or below, detection limits in the SVR monitoring wells. No increase in concentration was observed after utilization of these ponds.

There are presently no downgradient domestic uses of groundwater on the east side before constriction of the valley approximately 0.5 miles downstream of the SVR percolation ponds. Surface ownership is either SMC or USFS. It is believed that substantial mixing of groundwater occurs as a result of this constriction and that the Stillwater River changes from a losing stream to a gaining stream at this point, at least during part of the year.

3.2.3 Adit Water

SMC's underground workings produce, on average, approximately 500 gpm of water. The east side adit has produced on average about 244 gpm. The west side adit has produced

approximately 263 gpm of water. Under the company's proposal, average flows from the adits are expected to increase to 789 gpm.

Table 3.2-4 Mean Groundwater Concentrations Stillwater Valley Ranch Monitoring Well

	Location		
Parameter	MW-14A	MW-12A, 13A, 15A	MW-12A, 13A, 15A
Begin Date	November 1990	November 1990	May 11, 1991
End Date	May 1991	January 1991	May 11, 1991
Number of Samples	6	11	3
pH (Standard Units)	7.0	7.0	7.4
Specific Conductance (μmhos/cm)	221	136	272
Total Dissolved Solids (mg/L)	143	96	167
Major Cations (mg/L)			
Calcium	22	13	26
Magnesium	15	9	19
Sodium	4	3	4
Potassium	1	1	1
Major Anions (mg/L)			
Bicarbonate	119	83	89
Sulfate	20	7	55
Chloride	2	1	4
Hardness	116	71	89
Nutrients (mg/L)			
NO_2 + NO_3	1.01	0.11	3.48
Ammonia	<0.1	<0.1	<0.1
Kjeldahl Nitrogen	0.2	0.1	0.1
Orthophosphate	0.01	0.01	--
Dissolved Metals* (mg/L)			
Arsenic (0.005)	<0.005 (4)	<0.005 (6)	<0.001
Cadmium (0.001)	<0.001 (6)	<0.001 (11)	0.001
Chromium (0.02)	<0.02 (3)	<0.02 (5)	<0.02
Copper (0.01)	<0.01 (6)	0.01 (11)	<0.01
Iron (0.03)	<0.03 (4)	<0.03 (6)	<0.03
Lead (0.01)	<0.01 (6)	0.01 (11)	<0.01
Manganese (0.02)	<0.02 (4)	<0.02 (6)	<0.02
Molybdenum (0.005)	<0.005 (3)	<0.005 (6)	--
Nickel (0.01)	<0.01 (6)	<0.03 (5)	<0.01
Zinc (0.01)	0.03 (6)	0.02 (6)	0.01

Source: SMC, 1991b

* Parentheses indicates detection limit and number of samples at the reported detection limit. See footnote on page 71.

Interception of water-bearing bedrock structure has occurred throughout project development, and can be expected to increase with continued development and production. Interception of major water-bearing bedrock structure has been relatively rare. Initial drifting in the Minneapolis Adit encountered flows of 170 gpm in one area. In the spring of 1988, east side development intersected structure that is believed to be connected to No Name Creek. East side inflows of 150 gpm have resulted in increased adit discharge and subsequent reduction of the surface flow of No Name Creek.

More recently, a 600-gpm interception occurred during extension of west-side development. Intersected major water-bearing structures have dewatered rapidly, resulting in steady-state conditions that contribute moderately to average discharge volumes.

It has been observed that groundwater flow into the mine workings varies with seasonal and annual precipitation and recharge. This variation indicates that fracture systems are connected to surface recharge. At the present time groundwater inflows average about 500 gpm.

Mine water from the west side adits is collected and directed to the west side clarifier (SMC-3). Similarly, mine water from the east side workings is collected and routed to the east side clarifier (SMC-9). Water quality samples are taken after the addition of flocculent. Tailings impoundment (SMC-4) water is also sampled on a regular basis. Results of this sampling are summarized in Table 3.2-5.

SMC currently uses Ferralyte 8130 Coagulant as a flocculating agent in the east and west side clarifiers. This product is an aqueous solution of ferric sulfate and a polyamine polymer which increases the settling rate of the particulate material. As with most chemical reagents, it requires careful handling in concentrated form. This product is approved by EPA for use in potable water supplies. A majority of the flocculent, as well as the settled material, is slurried to the tailing impoundment for permanent disposal. Overflow, or clarified water, is directed to either the irrigation system or percolation ponds, depending on the season.

Since blasting increases the concentration of nitrogen compounds in adit water, nitrate (nitrite plus nitrate) and ammonia have been monitored more frequently than most other parameters. The average concentration of nitrate and ammonia is 9.34 and 2.2 mg/L, respectively, for the west side adit (SMC-3), and, 5.27 and 0.5 mg/L, respectively, for the east side adit (Table 3.2-5). The combined averages are 8.4 and 1.8 mg/L for nitrate and ammonia (Table 3.2-6). Nitrate levels can be minimized through proper usage of blasting compounds and minimizing contact with water.

Metal concentrations measured at the east side adit (SMC-9) indicate that both dissolved and total recoverable metal concentrations are at or below the limits of detection (Table 3.2-5). West side adit (SMC-3) concentrations are higher than the east side. The higher levels are most likely due to the data base used to develop these estimates. The west side clarifier was installed in August of 1989 and samples taken prior to this installation reflect the untreated condition. Clarifiers are highly effective for removal of particulate material. The other reason for higher concentration may be the greater degree of development and production on the west side.

Table 3.2-5 Mean Concentrations for SMC West Side Adit (SMC-3), East Side Adit (SMC-9) and Tailing Impoundment (SMC-4)

	Location		
Parameter	SMC-3	SMC-9	SMC-4
Begin Date	March 1987	November 1988	May 1987
End Date	January 1991	January 1991	December 1990
Number of Samples	15	9	8
pH (Standard Units)	7.3	7.8	7.2
Specific Conductance (μmhos/cm)	452	292	1,212
Total Dissolved Solids (mg/L)	262	132	966
Total Suspended Solids (mg/L)	85	113	87
Major Cations (mg/L)			
Calcium	53	23	150
Magnesium	6	6	18
Sodium	40	9	104
Potassium	2	<1	5
Major Anions (mg/L)			
Bicarbonate	86	87	60
Sulfate	114	19	522
Chloride	7	2	23
Hardness	153	83	452
Nutrients (mg/L)			
NO_2 + NO_3	9.34	5.27	14.73
Ammonia	2.20	0.50	1.83
Kjeldahl Nitrogen	3.10	0.40	2.31
Total Phosphorus	--	--	0.60

Metals*	Dissolved	Total Rec.	Dissolved	Total Rec.	Dissolved	Total Rec.
Cadmium (0.001)	0.001 (5)	<0.001 (5)	0.001(6)	<0.001(3)	<0.001 (3)	<0.005 (3)
Chromium (0.02)	<0.02 (5)	0.04 (5)	<0.02 (7)	0.02 (3)	0.02 (5)	0.04 (3)
Copper (0.01)	<0.01 (10)	0.02 (5)	<0.01 (7)	<0.01 (3)	<0.01 (5)	0.02 (3)
Lead (0.01)	0.01 (6)	0.11 (5)	<0.01 (6)	<0.01 (3)	0.01 (3)	0.02 (3)
Nickel (0.03)	0.03 (7)	0.07 (5)	<0.03 (7)	<0.03 (3)	0.03 (4)	0.06 (3)
Zinc (0.01)	0.01 (10)	0.05 (5)	<0.01 (7)	0.01 (3)	0.11 (5)	0.03 (3)

Source: SMC, 1991b

* Parentheses indicates detection limit and number of samples at the reported detection limit. See footnote on page 71.

Because of the concern for nondegradation, recent sampling by SMC has incorporated lower detection limits and additional parameters. These analyses included metals that are not necessarily associated with the Stillwater complex but may present health risks if present and are subsequently discharged to surface or groundwater. The results of these analyses indicate that antimony, arsenic, beryllium, mercury, selenium, silver and thallium, are below the limits of detection.

Based on the results of the SMC monitoring program, extended detection limit analyses and periodic sampling by the agencies, a composite adit water quality profile has been developed (Table 3.2-6). This composite represents the adit water quality after treatment (clarification) and reflect the quality of the present mine discharge. These values will be used to estimate water quality impacts

(Chapter 4). Drinking water maximum contaminant levels (MCL) and surface water criteria are presented for reference.

Table 3.2-6 Composite Adit Water Quality and Applicable Water Quality Standards

Parameter	SMC Adit Water	Maximum Contaminant Level	Surface[1] Water Quality Standard
pH (Standard Units)	7.5	--	6.5 to 8.5
Total Dissolved Solids (mg/L)	200	--	250
Total Suspended Solids (mg/L)	99	--	--
Major Cations (mg/L)			
Calcium	33	--	--
Magnesium	6	--	--
Sodium	22	--	--
Potassium	<1	--	--
Major Anions (mg/L)			
Sulfate	71	--	--
Nutrients (mg/L)			
Ammonia	1.8	--	1.8[2]
$NO_2 + NO_3$	8.42	10.0	10.0
Metals (mg/L)	Dissolved / Total Recoverable	Dissolved	Total Recoverable
Aluminum	0.04 / 3.48	--	--
Arsenic	<0.001 / <0.001	0.050	0.00002*
Barium	<0.1 / 0.005	1.0	1.0*
Cadmium**	0.00005 / <0.0001	0.005	0.0003
Chromium**	0.004 / 0.015	0.05	0.055
Copper**	0.0006 / 0.028	--	0.003
Iron	0.03 / 1.85	--	0.3*
Lead**	0.0004 / 0.007	0.015	0.0004
Manganese	0.02 / 0.03	--	0.05*
Mercury	<0.0002 / <0.0002	0.002	0.00001*
Nickel	<0.005 / 0.023	--	0.013*
Silver**	<0.0001 / <0.0005	0.05	0.0003
Zinc**	0.01 / 0.02	--	0.027

1) Freshwater chronic criteria unless otherwise noted.
2) Total ammonia (mg/L N) at ambient pH of 7.0 and 10°C.
* Human health criteria - Water and Fish Ingestion.
** Based on hardness of 20 mg/l (as $CaCO_2$).

3.3 Soils

A detailed (Order I) soil survey was conducted on about 5,320 acres in 1981. This included the 550-acre original permit area and all but 260 acres of the East Side Amendment area. Additional soil survey work was conducted on the 260-acre area in the spring of 1988. These soil surveys

indicate the predominant soils in the project area developed in alluvial or glacial deposits. A large portion of the SMC's developments on both sides of the Stillwater River have occurred on old disturbances. This has limited soil salvage. The natural soils in these old disturbed areas have not been described.

The predominant alluvial soils are Lolo and Nesda series. These soils in an undisturbed condition are mostly level (0-4 percent slopes) and are found on bottomlands and low level terraces along the Stillwater River. The upper horizons are characteristically dark-colored gravelly soil with soil textures ranging from loam to sandy loam. The upper horizons are about 15 inches thick. The average depth of salvageable soil was estimated at 8-9 inches of good materials with organic matter contents greater than 1 percent (Table 3.3-1).

The alluvial Lolo and Nesda subsoils have dark brown very gravelly horizons with soil textures similar to the surface horizons. These alluvial subsoils have 45-75 percent coarse fragments throughout the profile. The rocks are predominantly gravel size but some profiles may contain 25-35 percent cobbles. The subsoils were not included in soil salvage estimates because of rock content and/or a shallow depth to the water table.

The predominant glacial soils are Sebud and Tomy series. These soils occur along the lower slopes of the Stillwater River valley and are found on slopes from 4-40 percent. These soils are well drained and characteristically stony. Surface soil horizons are loam to sandy loam textured and grade to coarser textures at lower depths. About 25 percent of the surface is covered with stones and 5 percent is covered with boulders. Generally more stones are on the surfaces of crests of slopes rather than on lower slopes. The average depth of soil with fair salvage value ranges from 17-42 inches (Table 3.3-1).

Subsoils are pale brown to light yellowish brown and range in texture from stony clay loam to sandy loam to sand. Glacial subsoils were not recommended for salvage because of coarse fragment contents ranging from 30-65 percent of the soil volume and with sizes ranging from stone to boulders (Table 3.3-1).

Generally, soils in the SMC project area are moderately alkaline to moderately acid, are low in soluble salts and sodium, and are low to moderate in water and nutrient-holding capacity. Based on chemical data submitted by the company, there are no chemical elements in the soils that would pose a hazard to plants, animals, or humans (SMC EIS, Chapter III, p.25-28). Estimated salvage depths ranged from 0-84 inches. The predicted salvage depths were limited largely by coarse fragment contents, depth to water table, and depth to bedrock. In general, large amounts of potentially salvageable topsoil and subsoil layers exist with good and fair salvage value.

The proposed waste rock storage area on the east side of the Stillwater River covers 12.5 acres of disturbed soils covered with chrome tailings. Native soils underlying the chrome tailings have not been characterized.

Table 3.3-1 Soil Mapping Units Rated for Suitability as Source of Topsoil Material

Unit	Unit Name Or Series	Slope	Topsoil Rating and Depth			Limitation
			Good (in.)	Fair (in.)	Poor or Unsuited (in.)	
8	Nesda Gravelly Loam	0-4	8			Gravel, water table
2s	Nesda Loamy Sand	0-4		9		Gravel, water table
4	Cryofluvents Cryoborolls	0-25		10		Gravel, cobbles
8	Lolo Cobbly Loam	0-4	8			Gravel, water table
9	Nesda Gravelly Sandy Loam	0-4	8			Gravel, water table
30, 31	Sebud Stony Loam	4-25		42		Stones, boulders
33	Tomy Stony Sandy Loam	4-40		17		Stones, boulders
37	Taxi Stony Sandy Loam	45-60			0	Stones, slopes
38	Peel Sandy Loam	0-5		15		Coarse fragments
	Peel Stony Sandy Loam	0-60			0	Coarse fragments, slope
41, 42	Rock Outcrop, Part Sale	40-70			0	Bedrock, stones, slope
DS	Disturbed Soil	0-25			0	Not characterized, or chrome tailings

* Information from Table 5.2-4, SMC 1988 Amended Operating Plan (SMC, 1988) and Table 2.8-1 of SMC 1984 Application for an Operating Plan (SMC, 1984).

SMC has committed to salvage 14,800 additional cubic yards of topsoil from the additional acres of proposed disturbances:

Table 3.3-2 Soil Replacement Volumes

Mine disturbances	Replacement Volumes		
	Approved	Proposed	Total
Tailing Impoundment	12,000 Lcy/66.3 acres	2,000 Lcy	14,000 Lcy/51.6 acres
Waste Rock Storage	none	6,000 Lcy/15 acres	6,000 Lcy/15 acres
Mill support complex	6,500 Lcy/34 acres	5,700 Lcy/5 acres	12,200 Lcy/39 acres
Mine workings	18,500 Lcy/41.2 acres	1,100 Lcy/5 acres	19,600 Lcy/46.2 acres
Roads	2,500 Lcy/7.8 acres	0	2,500 Lcy/7.8 acres
Total	39,500 Lcy/149.3 acres	14,800Lcy/10.3 acres	54,300 Lcy/159.6
Average Replacement Depth/Acre	1.6 settled inches	2.0 settled inches	

SMC has 32,500 Lcy stockpiled and has used 6000 Lcy for final reclamation. SMC will have a total of 54,300 Lcy to reclaim almost 160 acres of disturbance. This equals a replacement depth of 2.0 inches of settled soil on mine disturbances.

3.4 Vegetation, Wildlife and Fisheries

3.4.1 Vegetation Types

The entire project area was included in the vegetation survey conducted during the original permit application process (Stillwater Project EIS, Chapter III, pages 28-35). Thirteen vegetation types, along with water, and disturbed sites supporting little or no vegetation were identified within the vegetation study area. These include stony grasslands, sagebrush shrublands, skunkbush shrublands, drainage bottomlands, riparian woodlands, ravine aspen-chokecherry, open forest-meadow understory, open forest-rocky understory, douglas-fir forest, subalpine forest, revegetated chrome tailings, cultivated haylands, and disturbed lands.

Predominant tree species in forested areas are lodgepole pine, douglas fir and limber pine. Most trees are pole-sized, poorly formed saw timber. No significant commercial values exist in the area.

Many of the proposed disturbances are located on revegetated chrome tailings or previously disturbed lands.

Noxious weeds in the project area are scattered. Under SMC's approved weed control plan on file with the Stillwater County Weed Control Board, the county applies herbicide to control spread of weeds on open ground.

3.4.2 Local Wildlife Species of Concern

The Stillwater River Valley supports a diversity of wildlife, comprised of 143 species of birds, 34 species of mammals, 6 species of reptiles and one amphibian species. Many of these occur, at least seasonally, in the area potentially affected by the proposed action.

The proposed amendment area and adjoining areas contain a mixture of wildlife habitats including boulder/talus field, rock cliff/benches, closed douglas-fir forest, open douglas-fir forest, ravine aspen, riparian woodland, meadow, disturbed grassland, stony grassland and skunkbush shrubland.

Three big-game species occur regularly within the proposed permit amendment area: mule deer, white-tailed deer and bighorn sheep. Two other species, black bear and mountain lion, are frequently present. Two species that are present elsewhere in the Stillwater Valley, elk and moose, probably occur only rarely within the immediate project area.

Mule deer are the most abundant big-game species in and near the proposed permit amendment area. While some mule deer are present on the site yearlong, it is primarily winter/spring range. This habitat extends north and west for several miles, and supported nearly 6,000 deer in the early 1980's with six reasonably distinct population units; one of which occupies the proposed amendment area. During the peak of winter range occupancy, it is common to observe more than 100 mule deer in the five miles between the Stratton Ranch and Woodbine Campground, with half of

these in or near the proposed amendment area. The number of mule deer in the proposed amendment area has remained stable or increased since the early 1980's (see also the Stillwater Project EIS, Chapter III, pages 41-46).

White-tailed deer occur yearlong in the riparian woodland along the Stillwater River. They are occasionally seen in the lower elevations of the proposed amendment area, primarily along the river. The number of white-tailed deer in the upper Stillwater Valley has increased since the early 1980's (see also the Stillwater Project EIS, Chapter III, pages 46-47).

The Stillwater Valley bighorn sheep population has declined significantly in recent years from a high of 60 animals in the winter of 1977-78 to a low of 24 animals in the winter of 1990-91. Between 1972 and 1982 this population supported an average annual lamb recruitment of 10.8 lambs per year. Since 1983 average lamb recruitment has declined to only 4.0 lambs per year. Since 1988 average lamb recruitment has been only 1.75 lambs per year. Between 1972 and 1985 adult ewe mortality averaged 7.7 percent annually. Since 1986 the ewe mortality rate has doubled to an average of 15.3 percent per year. Extinction of this population remains a real possibility if the population trend does not improve in the very near future (Stewart, 1991, personal communication; IV-27 EIS, 1985).

Several potential sources of stress to the bighorn population have been identified. Habitat use patterns have changed dramatically since the 1970's, with significant increase in use of high-security habitats and a decrease in use of traditional habitats where forage quantity and quality was highest in the 1970's. The change in habitat use was accompanied by an increase in daily movements. Thus, energy expenditure was increased at the same time that energy intake was reduced. This pattern is thought to be, at least in part, the result of increased human activity on the winter range. There is also some evidence to suggest that forage composition on the winter range has changed since the 1970's, with a reduction in the forb component a major part of the bighorn sheep's winter diet. At the same time forage nutrition may have decreased, though data on this point are not conclusive. Increased numbers of mule deer and white-tailed deer on the traditional bighorn sheep winter range probably have resulted in increased competition for some forage species. Dietary overlap is probably greatest for forbs - the component of the winter range that is decreasing in availability. Additionally, portions of the winter range have been overgrazed by domestic cattle and horses in recent years. Lastly, there is some speculation that increased populations of predators, especially mountain lions, may be impacting the bighorn sheep, both in terms of direct mortality and increased energy expenditure due to harassment (SMC, 1991).

The cumulative affect of these stresses to the bighorn population has resulted in a dramatic increase in lungworm levels in the bighorn sheep. The high level of lungworm in conjunction with pneumonia (lungworm/pneumonia complex) is thought to be the primary cause of the increased mortality rate for bighorn lambs and ewes.

Numerous management activities are underway to address the many stress factors that appear to be operating against the Stillwater bighorn herd. Recent attempts to medicate the bighorns to reduce lungworm levels appear initially to have been successful. Several efforts are underway to improve the quality of the traditional winter range. An intensive domestic livestock grazing program

has been implemented to improve forage composition. Portions of the winter range have been reseeded with species that are highly palatable to bighorns. Other portions of the winter range have been treated with a controlled burn to stimulate plant nutrition and productivity. Direct fertilization of portions of the winter range is being explored. Human access to the winter range has been essentially eliminated between December 1 and April 15 each year. Attempts are also being made to reduce populations of mule and white-tailed deer through increased hunting pressure. Whether or not this management effort to reverse the bighorn's population trend will be successful remains unknown (SMC, 1991).

Black bears frequent the proposed permit amendment area during spring, summer, and fall. Black bears have also been known to den at upper elevations in the proposed amendment area. While there is no specific population data for this area, there is considerable evidence that the black bear population on the entire Beartooth face is declining. This decline is primarily due to excessive man-caused mortality (Shawn T. Stewart, Montana Department of Fish, Wildlife and Parks, (DFW&P) Pers. Comm., 1991).

Mountain lions are also frequently found in the proposed permit amendment area. During the winter of 1989-90, DFW&P personnel in cooperation with SMC employees captured and radio collared four lions on or near the permit amendment area. There was thought to be at least one other adult lion and two subadults in the immediate area that were not captured. Of these 7 lions there were probably only 3 resident adults. The radio-collared lions moved over a much larger area than just the proposed permit amendment area, but one adult female did spend a large portion of her time in and near this area. In general, the lion population across the Beartooth face appears to be increasing (Shawn T. Stewart, DFW&P, Pers. Comm. 1991).

Two species of upland game birds have been observed in or near the proposed permit amendment area. Blue grouse have been recorded in the open douglas-fir forest, particularly at higher elevations. Ruffed grouse have been seen in the ravine aspen and riparian wildlife habitat types. Both species are considered common although population levels have apparently declined in recent years (Shawn Stewart, DFW&P, Pers. Comm., 1991).

3.4.3 Threatened, Endangered, and Sensitive Species

The bald eagle is a federally listed endangered species that is known to occur in or near the permit amendment area. The majority of the eagle use occurs during the winter and spring when eagles migrate through the upper Stillwater Valley. Some birds reside along the river throughout the winter. Bald eagles are not known to nest in the area.

Additionally, the peregrine falcon is listed as an endangered species known to occur in or near the proposed permit amendment area. Peregrine falcons were known to nest on a cliff several miles downstream from the proposed permit amendment area in 1975-76. There have been unconfirmed reports of activity near this site through the early 1980's. Peregrine falcons are also occasionally observed in the Stillwater in fall and winter. These observations are probably of migrating birds. There has been no evidence of nesting in or near the proposed permit amendment area.

Thirteen species of birds of prey have been recorded in the large study area encompassing the proposed permit amendment area. The proposed permit amendment area contains four habitats that are attractive nesting sites for raptors: cliffs (primarily for golden eagles), open douglas-fir forest (primarily for red-tailed hawks), and ravine aspen and riparian woodland (primarily for accipiters, red-tailed hawks and great horned owls). Other species such as the American kestrel and other species of owls may utilize all of these habitats.

There is one known raptor nest within the area affected by this proposed amendment. A golden eagle nest occurs on the cliff immediately above the SMC offices. This nest has only been active once since 1980 (in 1987). Golden eagles are frequently seen in the area but there has been no recent activity at the nest.

3.4.4 Fisheries

The Stillwater River and the West Fork Stillwater River near and downstream of the proposed permit amendment area are considered to be "substantial fisheries resources" (Jim Darling, DFW&P, Pers. Comm. 1988). Brown trout, rainbow trout, brook trout and mountain whitefish make up most of the fish biomass in the Stillwater River. Cutthrout trout were last collected in 1974. Rainbow-cutthroat hybrid trout are infrequently encountered. Non-game fish are also present throughout the river system.

The nature of the gravel substrate, shallow side channels, flow regimes, water quality and stream gradient make the Stillwater River above Beehive, Montana ideal for spawning and rearing game fish that live in the lower Stillwater and Yellowstone rivers. Baseline sampling conducted for the original EIS indicates that aquatic invertebrate communities in the Stillwater River are highly diverse and abundant. May flies and true flies are the most highly distributed and diverse insect groups. Many of the may flies, stone flies and caddis flies are considered to be sensitive to environmental degradation.

The diversity of aquatic invertebrates found in three tributary streams (Nye Creek, Verdigris Creek, and Mountain View Creek) in the project area was much lower than in the Stillwater River. Nye Creek, which drains a portion of the amendment area, had the poorest diversity of aquatic organisms. Suitable habitat for aquatic insects in lower Nye Creek is limited by chromium mine tailings.

Fish populations in Nye Creek are apparently limited to salmonids, with brook trout the most abundant. Compared to the Stillwater, the tributary streams contain very limited fisheries potential.

3.5 Air Quality and Climate

3.5.1 Air Quality

Ambient air quality in the project area is generally very good. SMC operates two air quality monitors in the immediate mine area. The parameter monitored is PM-10 (particulate matter with a diameter of less than 10 microns). The results have shown that particulate levels have remained well below the applicable ambient air quality standards. The following table summarizes the data for calendar year 1990 and includes the standards for comparison.

Table 3.5-1 Summary of the PM-10 Suspended Particulate Data January, 1990 - December, 1990
Stillwater Mine, Nye, Montana

Site	Ambient 24-hour Standard	Maximum 24-hour	Second Highest 24-hour	Ambient Annual Standard	Annual Average	Number of Samples
1	150*	34	33	50	10	46
2	150*	47	41	50	13	49

* Not to be exceeded more than once per year.
(Values are in micrograms per cubic meter)

The sampling has also included trace metal analyses of the particulate filters. These levels have also remained low and less than applicable guideline concentrations.

The major sources of particulate and gaseous air pollution in the area are the on-going mining activities, vehicle traffic, and wood burning. The surrounding area, including the Absaroka-Beartooth Wilderness, is designated as Class II under the Prevention of Significant Deterioration (PSD). The nearest Class I area is Yellowstone Park located about 20 miles to the south. Class I areas are provided the highest level of protection from air quality impacts under the PSD regulations.

Baseline air-quality monitoring was performed in the project area prior to the beginning of mining operations (July 1980 - July 1981). Total suspended particulate (TSP) monitoring sites were located at the Hertzler Ranch, the Beartooth Ranch, and the mine site. Results of this monitoring indicated quite low TSP levels, typical of natural background levels.

Computer simulation modeling of emissions submitted in support of SMC's original air quality permit application (not including activities under the proposed amendment) indicated a moderate increase in TSP levels. The annual TSP level was estimated to increase to about 35 micrograms per cubic meter ($\mu g/m^3$). This compares to baseline levels of about 15-20 $\mu g/m^3$ and the annual TSP standard of 75 $\mu g/m^3$ which was in effect at the time.

3.5.2 Climatology and Meteorology

The climate of the area is described as modified continental. This type of climate is characterized by large daily and annual temperature ranges and marked differences in precipitation, temperature, and wind patterns over distances of only a few miles.

Average annual precipitation ranges from 20 to 25 inches. Over 53 percent of this falls during March through June. About 3.5 inches falls monthly during April, May, and June. The percentage of total precipitation occurring as snow increases with elevation. Below 5,000 feet snow accounts for 15 to 20 percent of the total, while above 9,000 feet snow sometimes accounts for as much as 90 percent.

Heavy thunderstorms occasionally take place in July and August and less frequently in June and September. There is a 20-percent chance a one-inch rainfall will occur in one hour in any given year, whereas a three-inch total in 24 hours could be expected one year in ten. Hailstorms also occur infrequently.

The annual average temperature is about 42°F and decreases with increasing elevation. At 10,000 feet, the average is estimated to be about 30°F. The warmest months are July and August and the coldest is January. At lower elevations the first freezing temperature in autumn normally occurs in mid-September and the last occurs in mid-June. At elevations above 7,500 feet, freezing temperatures may occur at any time.

Wind speed and direction were measured at the mine site and the Hertzler Ranch site from September 1, 1980, through August 31, 1981. Prevailing winds are from the southwest to the northwest throughout the year. The average wind speed was 10 miles per hour (mph) at the mine site and 7.4 mph at the Hertzler Ranch site. Only during August was the month's average wind speed lower at the mine site than at the Hertzler Ranch site. Maximum hourly wind speeds were usually greater at the mine site.

3.6 Land Uses

3.6.1 Recreation

The public utilizes the Woodbine Campground area heavily during the summer and fall months. Recreational activities consist of camping, fishing, and hiking. The public must travel through the bighorn sheep winter range on FAS 419 and FAS 400 in order to access the Woodbine Campground and Trailhead. The level of developed recreational use has remained the same over the last several years. However, use of the trailhead facilities leading into the Absaroka-Beartooth Wilderness has shown a slight decrease in visitor use.

3.6.2 Wilderness

The lowest elevation access point to the Absaroka-Beartooth Wilderness is located approximately 3.5 miles to the south of the Stillwater Mine. The area typically remains snow-free for

extended periods of time during the winter months. Prior to 1988, the Woodbine trailhead experienced the highest use of any trailhead on the Beartooth Ranger District. During the summer of 1988, the area upstream of the trailhead experienced varying degrees of fire activity during the Storm Creek Fire. Following the burn, use in the area dropped. This use trend has continued to present.

Currently, access to the Absaroka-Beartooth Wilderness is precluded from December 1 to April 15 of each year. This measure was required by condition-of-approval mitigation measures contained in the 1989 EA/PER for the East Side Mine Expansion Amendment.

3.6.3 Beartooth Ranch Operation

This facility occupies a significant segment of the bighorn winter range. As currently managed, approximately 25 vehicles per day traverse the winter range on the old road along the Stillwater River, with about one-half of these trips related to SMC (Richter, 1991, personal communication). The remaining traffic is associated with ranch business. The ranch is used as a source of lodging for business visitors, as well as a seasonal tourist resort. The forage base of the ranch is improving as compared to past range conditions.

3.6.4 Land Uses Outside the National Forest

Much of the land in the Stillwater Valley that is outside the national forest is privately owned, but there are also tracts owned by the state and some that are administered by the BLM. Lands near the mine that are not part of the CNF are used for agriculture, recreation, mining, residences, and wildlife habitat. Grazing is a major agricultural use in the valley, and Section 3.8.4 contains a more detailed discussion of the agricultural industry in Stillwater County.

Mining activity in the Stillwater Complex, of which this area is a part, began in the 1880's when sulfide-rich rocks containing copper and nickel were discovered (Page et al., 1985). Chromite also occurs in the Stillwater Complex, and the Benbow, Gish, and Mouat mines were developed in the early 1900's for the purpose of mining chromite. Over the years, chromite production from these mines was associated either with wartime needs or with U.S. government stockpiling programs, and chromite mining in the area ended in 1961 after the U.S. government did not renew the stockpiling contract with American Chrome Company. Increased interest in platinum-group metals in the Stillwater Complex in the 1960's and 1970's eventually led to the development of SMC's platinum palladium mine near the site of the Mouat operation. Thus, there is a long history of mining in the area which predates many of the other land uses.

The area contains both year-round and seasonal homes with land along FAS 420 a popular location for many of the seasonal structures. Subdivisions in the vicinity of the mine include the Cathedral Mountain Ranch, the Rainbow Ranch, the Whited subdivision, the Buffalo Jump Ranch, and the Stratton Ranch which was developed to provide temporary mobile home accommodations to mine employees.

Recreational pursuits outside the national forest parallel those that occur on the national forest. Some of the more common recreational activities which people participate in are camping, picnicking, hunting, and fishing.

The use of the area for wildlife habitat is evaluated in Section 3.4.

3.7 Aesthetics

3.7.1 Visuals

The CNF manages its scenic resources with the USFS Visual Management System, which incorporates inventories of all of the forest's acres for visual attributes that will determine a rating of landscapes corresponding to management objectives. These VQO's are desirable limits of acceptable change that could take place as a result of management goals and objectives. As described in Volume 2, Chapter 1 of the National Forest Landscape Management System, VQO's allow for a certain degree of management activities to take place with respect to frequency, distance and type of visitor observation, and the ability of the landscape to absorb alteration. (See Chapter 4 for more detailed discussion of visual quality parameters.) Major travel and recreation corridors are usually the most sensitive, requiring the most stringent controls governing discernable changes in the natural landscape. Less traveled, lower standard roads reflect a descending hierarchy of visual constraints appropriate to the character of the land and the general purposes of the visitor. These objectives are listed below in order of least noticeable alteration to the most allowable, as seen by the average forest visitor:

PRESERVATION - allows for ecological changes or very low visual impact recreation activities.

RETENTION - allows for management activities that are not visually evident.

PARTIAL RETENTION - allows only for management activities that are visually subordinate to the characteristic landscape.

MODIFICATION - allows management activities to visually dominate the landscape only if they are in harmony with the naturally occurring form, line, color, texture, and scale of the characteristic landscape.

MAXIMUM MODIFICATION - allows management alterations to dominate the landscape and diverge from natural occurrences in foreground and middleground; however, these activities must be in harmony with the existing natural surroundings when viewed as background.

The landscape character of the project area is distinctive in landform and vegetative variety. From the broad, U-shaped, glacier valley floor where hay fields surround the riverbed to entire ridges of bare rock outcrop or steep slopes covered with stands of lodgepole pine or douglas fir, the area is an outstanding example of the Yellowstone Rockies character type. In addition, FAS 419 passes through the mine area to access the Absaroka-Beartooth Wilderness. For these reasons, the observed area of the forest near the mine site has been assigned the visual objective of Retention. The plant site, adits, and access roads within this area are also designated in the CNF Management Plan (USFS, 1986) as Management Area E with emphasis on mineral development. Public viewpoints of the plant site are numerous along the FAS 419 until it passes the site. There are also a limited number of points within the Cathedral Mountain Ranch subdivision that overlook part of the site at a distance of

2 to 3 miles. The desired future condition for the forest on potential mineral lands like these require minimizing disturbances and adverse impacts in the short term and the maintenance of sufficient controls during operations to assure the accomplishment of long-term goals. The Retention objective is expected to be met at some point after the life of the mine has expired and reclamation has been completed.

3.7.2 Noise

The mine currently works on an around-the-clock schedule, and utilizes car pooling for workers that commute from outlying areas. The increased production level and concomitant addition of personnel should not make a significant change in off-site noise levels from the present situation.

3.8 Socioeconomics/Traffic

The economic and social impacts of the proposed mine expansion would extend well beyond the project site, even as far away as Belgium where the matte produced from the Columbus smelter will be shipped for refining. Nevertheless, it is necessary to place a limit on the geographic scope of the economic and social analysis; therefore, based upon such considerations as the residential, shopping, and commuting patterns of workers, the analysis area for the major economic and social impacts of the project is defined to be Stillwater County, Montana. This is consistent with the study area definition used in the December 1985 EIS and the affected jurisdictions included in the Hard Rock Mining Impact Plan.

3.8.1 Population

According to Bureau of the Census estimates, the population of Stillwater County on April 1, 1990 was 6,536, a 16.8 percent increase over the 1980 figure of 5,598. Over the last two decades, the rate of population growth in Stillwater County has exceeded that for both Montana and the United States (Figure 3.8-1). Although the expansion in the population slowed somewhat in the 1980's compared to the previous decade, the average annual rate of increase was still 1.6 percent, about 50 percent higher than the growth rate for the U.S. and 10 times the Montana rate.

The urban-to-rural migration which was prevalent throughout many areas of the United States in the 1970's appears to have been a factor in the population growth in Stillwater County, as does the development of the Stillwater Mine in the 1980's. Impact Plan monitoring data for March 31, 1991, indicates that, of the total 364 employees of the mine, 195 (53.6 percent) were classified as in-migrants and 169 (46.4 percent) as residents. Using an average household size of 3.0 persons per employee as reported in the Impact Plan, this would mean that the mine would account for roughly 585 persons of the population increase.

Within Stillwater County, the population changes over the 1980-1990 period were, by no means, uniform. The largest population growth occurred in the Absarokee division[3], where the population rose from 1,407 in 1980 to 1,914 in 1990, an increase of 36.0 percent. The population of the Columbus and Park City divisions expanded by 14.8 and 14.3 percent, respectively, while the number of inhabitants of the Stillwater North division declined by 16.5 percent (96 persons) over the 1980-1990 period. The town of Columbus grew from 1,439 persons in 1980 to 1,573 in 1990, a 9.3 percent increase.

Given the proximity of Absarokee to the Stillwater Mine, it is not surprising that the population growth was concentrated in the Absarokee division. A February 1989 survey of SMC employees showed that 58.9 percent commuted from either Absarokee or between Absarokee and the mine, 21.4 percent from Laurel/Columbus, 10.0 percent from Red Lodge/Luther/Roscoe, and the remaining 9.7 percent from within 3 miles of the mine (SMC, 1989).

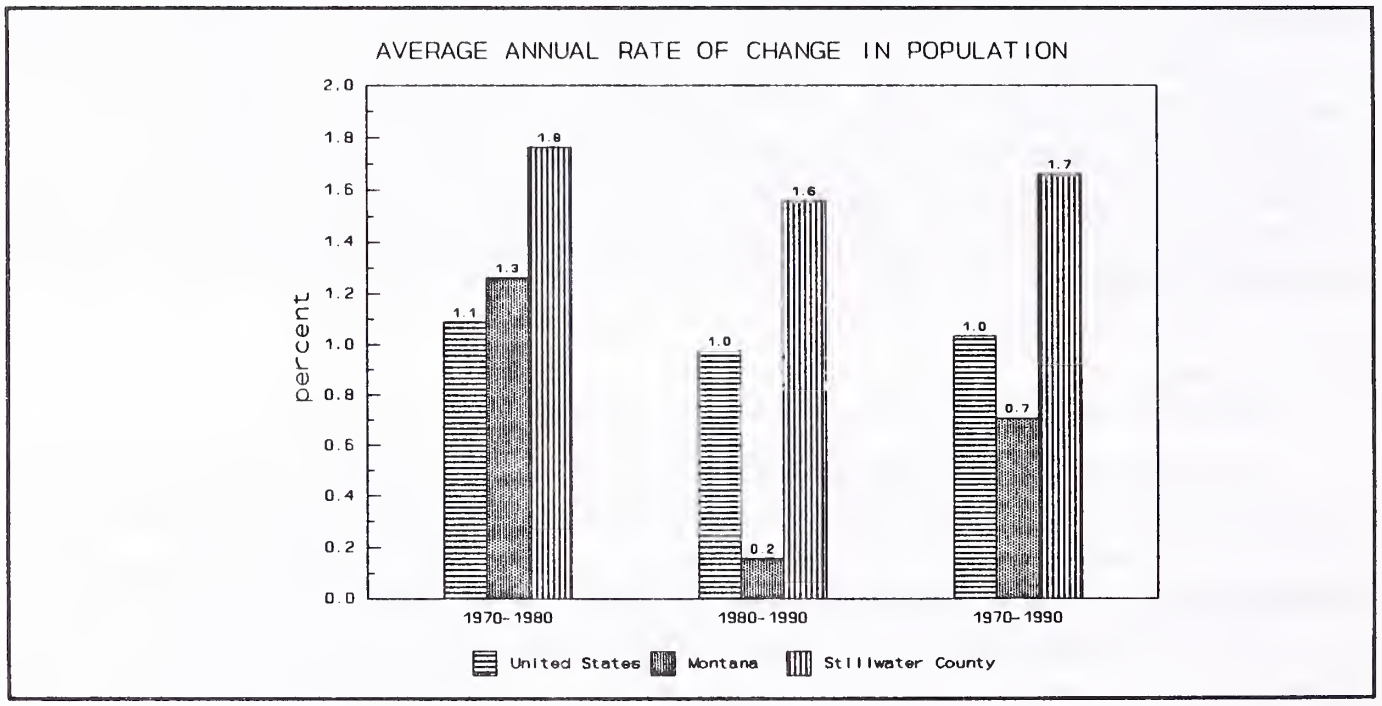

Figure 3.8-1 Average Annual Rate of Change in Population

Figure 3.8-2 shows the relative distribution of the population, by race, for the United States, Montana, and Stillwater County based upon census data for 1990. As seen in this bar graph, racial minorities account for a smaller percentage of the population in Stillwater County than in Montana or the United States, as a whole. American Indians were the largest racial minority in the county, making up 0.8 percent of the population. Persons of Hispanic origin, who may be of any race, constituted the largest minority group at 1.4 percent of the 1990 Stillwater County population compared to 1.5 percent for the state and 9.0 percent for the U.S.

[3]Since 1990 is the first year in which census data are available down to the block level for rural counties, population comparisons with 1980 for Stillwater County are made only for the larger census county divisions (CCD's).

Data from the 1990 census on the distribution of the population by age shows that the Stillwater County population tends to be somewhat older than the statewide average which could be a reflection of the lack of job opportunities for younger residents or the attractiveness of the area to retirees. The median age in Stillwater County is 36.5 years compared to 33.8 years for the state. Persons 65 years of age and older account for 16.7 percent of the Stillwater County population while 13.3 percent of the Montana residents are in that category. The proportion of females in the Stillwater County population is slightly lower than that of the state (50.1 percent for Stillwater County versus 50.5 percent for Montana).

3.8.2 Labor Force

The civilian labor force in Stillwater County averaged 3,347 in 1990 with 3,229 employed and 118 unemployed. The unemployment rate was, therefore, 3.5 percent, much lower than the statewide or U.S. figures. In the early 1980's, the Stillwater County unemployment rate was also substantially below the U.S. and Montana rates, but the rate more than doubled in 1982 and rose again in 1983, putting Stillwater County above the others (Figure 3.8-3).

Wage and salary employment, which is on a place-of-work basis, did not change nearly as much as the number of unemployed (place-of-residence basis), suggesting that a large portion of the newly unemployed came from workers who were commuting to other counties for their jobs. During 1982 and 1983, several developments occurred in other counties which may have affected Stillwater County residents. Among these were the shutdown of highway construction near Big Timber due to a labor dispute between operating engineers and general contractors, layoffs in the food processing industry in Billings, and cutbacks at the railroad in Laurel (Research and Analysis Bureau, various quarters).

Hiring at the Stillwater Mine reduced the number of unemployed, and over the 1988-1990 period the jobless rate in the county was below that of the U.S. and Montana. In March of 1991, however, the Stillwater County unemployment rate jumped to 10.6 percent of the work force as a result of about one-fourth of the workers at the Stillwater Mine being laid off in a move designed to lower costs. By June, the unemployment rate had declined somewhat to 9.1 percent, but was still well above the unemployment rate for Montana and the United States. In comparing the Quarterly Impact Monitoring Reports for December 31, 1990 and March 31, 1991, resident employment fell by 89 persons, while 30 of the in-migrating employees lost their jobs. Thus, residents, who comprised 47.8 percent of Stillwater mine employees on December 31, 1990, made up a disproportionate share of the March layoffs. Over the January 31, 1990 to December 31, 1990 period, however, resident employment rose by 44 persons while only 1 additional job was filled by a nonresident of the county. The most-recently hired employees, who were mostly residents, likely did not possess the level of skill and experience of others already working at the mine, so they were more vulnerable when the layoffs occurred.

Table 3.8-1 Labor Force Statistics for Stillwater County

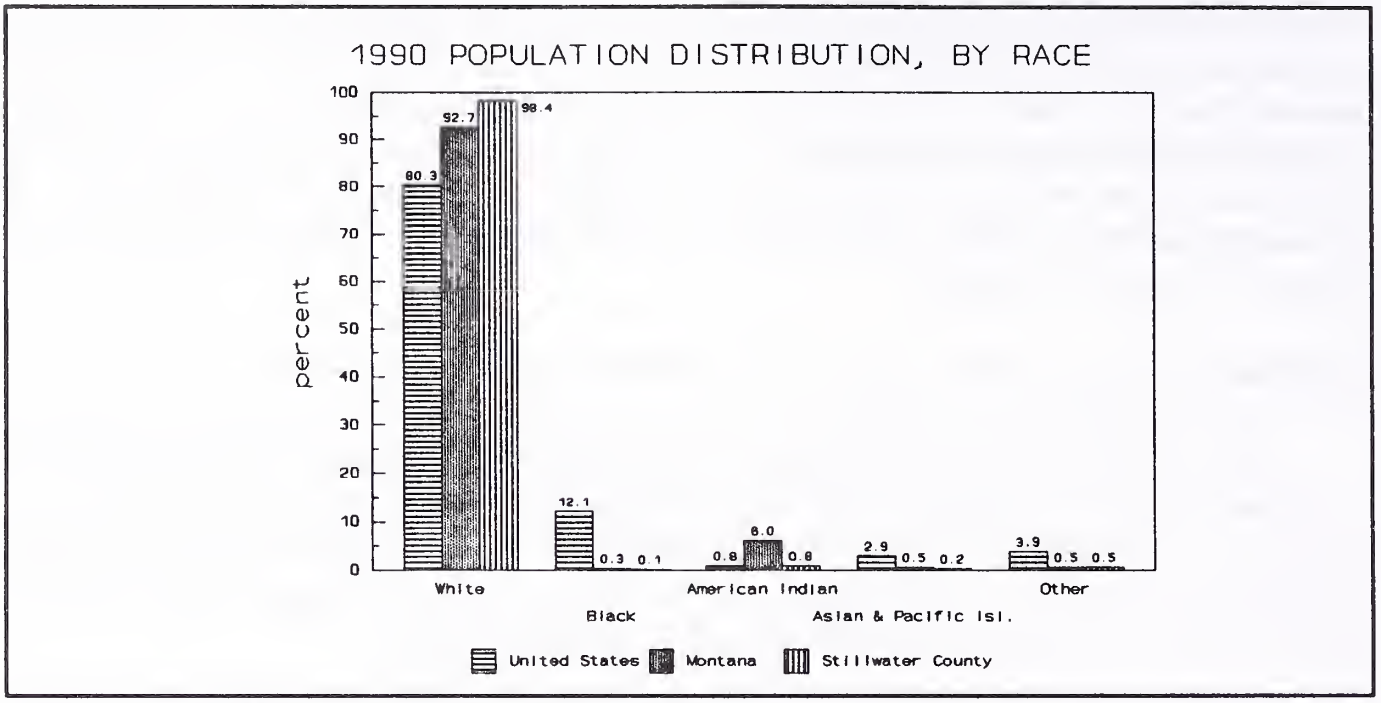

Figure 3.8-2 1990 Population Distribution, by Race

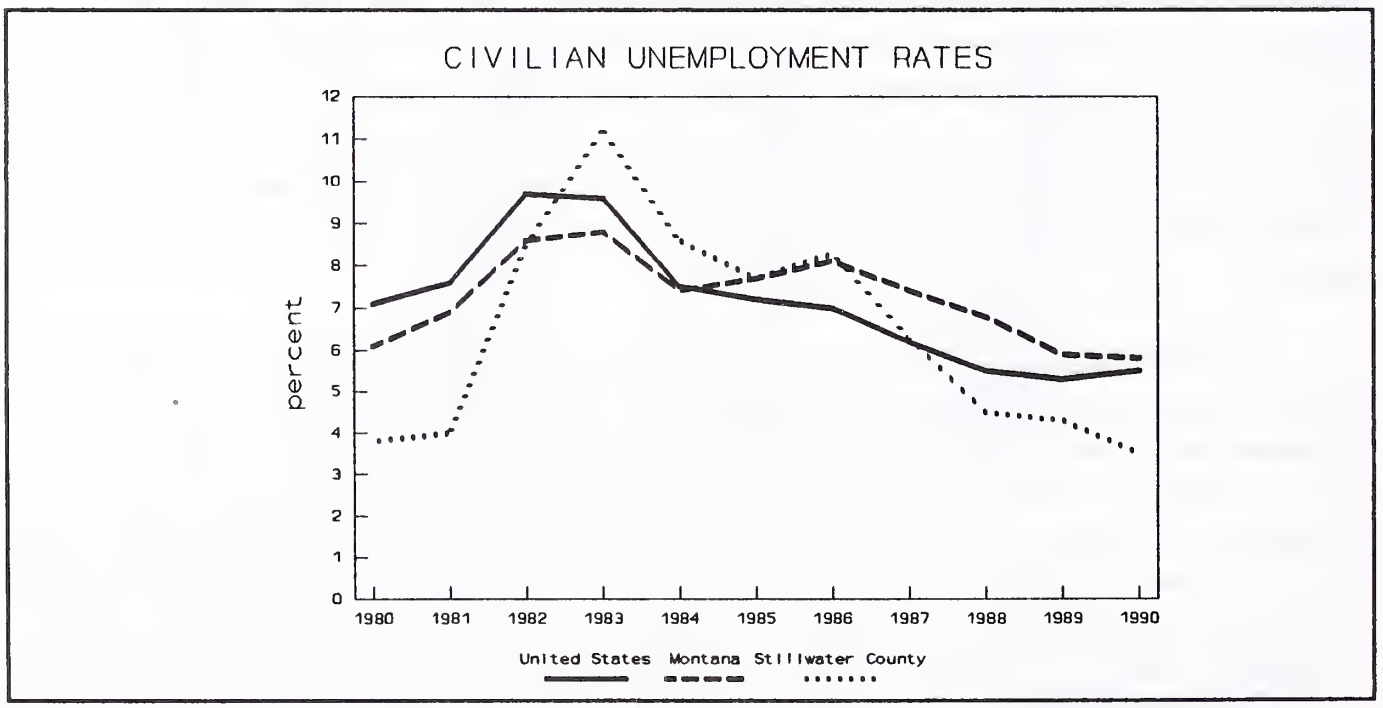

Figure 3.8-3 Civilian Unemployment Rates

	1986	1987	1988	1989	1990
Labor Force	2,685	3,063	3,153	3,285	3,347
Employment	2,462	2,869	3,012	3,145	3,229
Unemployment	223	194	141	140	118
Unemployment Rate	8.3%	6.3%	4.5%	4.3%	3.5%

Source: Research and Analysis Bureau, June 1990 and 1991.

3.8.3 Personal Income

Personal income is the income received by persons from all sources including wages and salaries, proprietors' income, transfer payments, dividends, interest and rents. Expressed in constant

1990 dollars, personal income totalled $107.6 million in 1989. Labor income accounted for 50.8 percent ($54.6 million) of the total, a far lower percentage than for the state (Table 3.8-2). The residence adjustment for income earned outside Stillwater County made up a much larger percentage of personal income, 12.6 percent, than the statewide figure. The labor income and residence adjustment percentages are indications of the degree of commuting that occurs by Stillwater County residents to jobs in other areas (e.g., Billings) and the attractiveness of Stillwater County as a place to live.

Table 3.8-2 1989 Personal Income by Major Component
(expressed in thousands of 1990 dollars)

			Percent of Total	
	Stillwater County	Montana	Stillwater County	Montana
Total Personal Income	107,563	11,962,558	100.0	100.0
Social Security contribution	-3,963	-576,069	-3.7	-4.8
Residence adjustment	13,531	14,335	12.6	0.1
Dividends, interest, and rents	24,933	2,554,847	23.2	21.4
Transfer payments	18,430	2,234,021	17.1	18.7
Labor Income	54,631	7,735,425	50.8	64.7

Source: University of Montana Bureau of Business and Economic Research, July 1990

Note: Social Security contributions are deducted from other components to derive total personal income.

Per capita income, a measure of economic well-being, was $16,742 in Stillwater County in 1989, compared to $18,474 for the U.S. and $14,857 for Montana. Per capita income for Stillwater County and Montana was, therefore, 90.6 percent and 80.4 percent, respectively, of the U.S. amount. The per capita income was relatively equal among the United States, Montana, and Stillwater County in the early to mid-1970's, but after that, the per capita income in the U.S. continued to rise while Montana and Stillwater County remained flat (Figure 3.8-4). With the opening of the mine, the gap between the U.S. per capita income and that of Stillwater County has been narrowing.

3.8.4 Structure of the Local Economy

The distribution of labor income among major industries provides some insight into the structure of an economy. Table 3.8-3 shows labor income for Stillwater County and Montana. Because of the limited number of firms in the mining and manufacturing industries in Stillwater County, labor income for those categories is not disclosed by the Bureau of Economic Analysis. Data published by the Montana Department of Labor, however, suggests that mining accounts for over one-fourth of total labor income, while labor income in manufacturing is fairly close to the statewide figure of 8.4 percent. Compared to the state, agriculture and mining are relatively more important industries with most others making up a smaller percentage of total labor income than corresponding industries in the state. Lower percentages for such industries as trade, services, and finance, insurance, and real estate show that residents leave the county to purchase many goods and services.

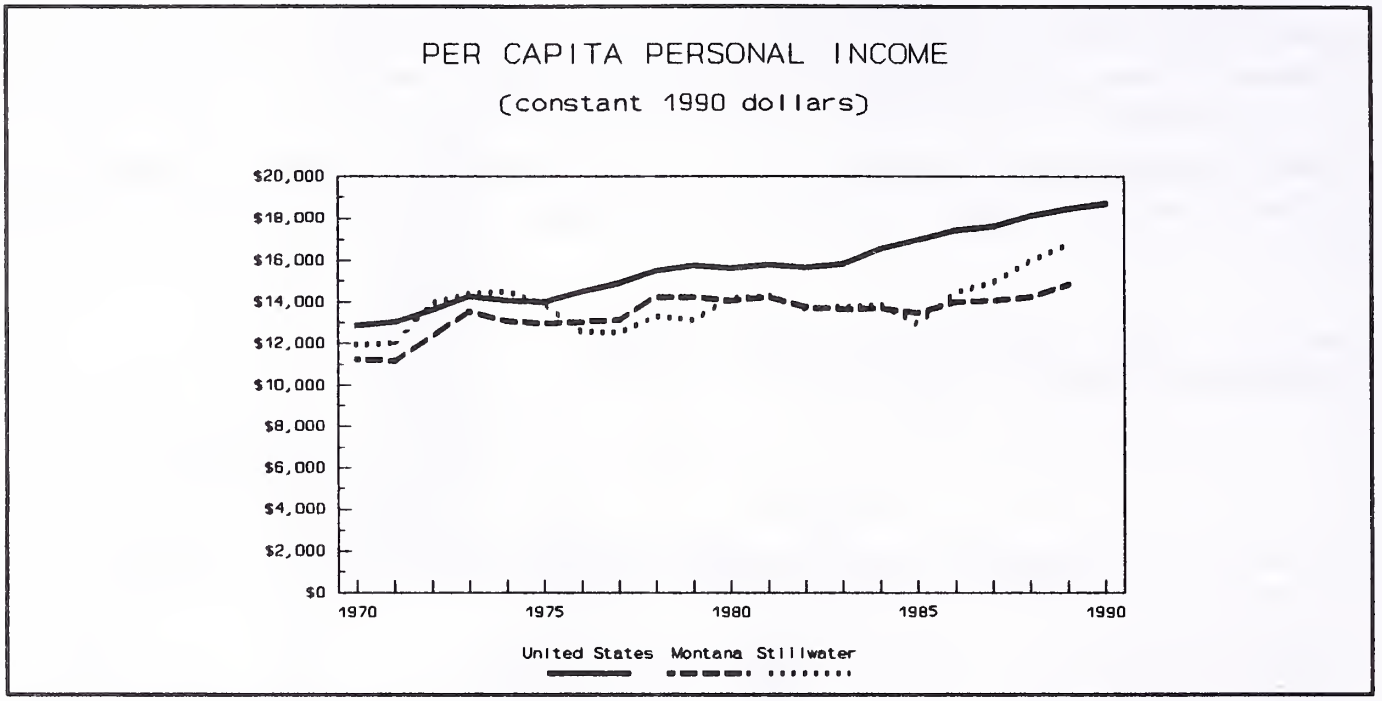

Figure 3.8-4 Per Capita Personal Income

Table 3.8-3 1989 Labor Income by Major Industry Stillwater County and Montana (expressed in thousands of 1990 dollars)

			Percent of Total	
	Stillwater County	Montana	Stillwater County	Montana
Total Labor Income	54,631	7,735,425	100.0	100.0
Agriculture	7,669	498,093	14.0	6.4
Agricultural Services, Forestry and Fisheries	345	55,332	0.6	0.7
Mining	(D)	260,108	(D)	3.4
Construction	1,908	425,499	3.5	5.5
Manufacturing	(D)	650,236	(D)	8.4
Transportation, Communications and Public Utilities	2,311	756,265	4.2	9.8
Wholesale Trade	1,240	405,844	2.3	5.2
Retail Trade	4,437	892,510	8.1	11.5
Finance, Insurance, and Real Estate	291	329,380	0.5	4.3
Services	7,033	1,867,462	12.9	24.1
Government	6,856	1,594,696	12.5	20.6
Federal Civilian	881	413,879	1.6	5.4
Federal Military	254	139,807	0.5	1.8
State and Local	5,721	1,041,009	10.5	13.5

(D) Not shown to avoid disclosure of confidential data. Data included in totals.
Source: Bureau of Economic Analysis, April 1991.

For rural counties, this parallels the behavior observed at the statewide level. Swanson (1991) has categorized Montana counties into a trade center hierarchy with six tiers. Tier 1 counties, including Stillwater County, are the least populated with the number of residents less than 5,000. At the top of the hierarchy are the Tier 6 counties (Cascade, Missoula, and Yellowstone) whose population is greater than 60,000. According to Swanson, retail trade activity has been shifting up the trade hierarchy over the years. Between 1972 and 1987, retail sales, measured in constant dollars, have dropped by 31 percent in the Tier 1 counties, compared to an increase of over 20

percent for the Tier 5 and 6 counties. The services sector also has been growing more rapidly in the more populated counties, as evidenced by the increase in service's industry labor income of over 100 percent in Tiers 5 and 6 between 1972 and 1988, while the expansion in labor income in the Tier 1 counties was a much lower 31 percent.

According to the most recent Census of Agriculture, there were 447 farms in Stillwater County in 1987, 4.2 percent more than in 1982 when the previous census was made. The amount of land in Stillwater County farms declined, however, to a level of 842,673 acres, resulting in an average farm size for the county of 1,885 acres. On average, farms in Stillwater County are roughly 4 times the size of the average U.S. farm, but 23.1 percent smaller than the statewide figure.

The market value of agricultural products sold in Stillwater County totalled $26.2 million in 1987 compared to $23.8 million in 1982. When adjusted for inflation, however, the 1987 value was 6.2 percent less than 5 years earlier. The average value of agricultural products sold per farm was $58,637 in 1987 in Stillwater County, which was lower than the average for Montana and the U.S. Over three-fourths of the value was generated from the sale of livestock, poultry, and their products and just under one-fourth from crops. In 1982, livestock and poultry accounted for 63 percent of the total value of products sold. Cattle and calves make up the largest component of livestock and poultry sold in Stillwater County with hogs and pigs, sheep and lambs, and chickens also important. Wheat was the dominant crop grown in the county in 1987, and hay, barley, and corn were other crops that were harvested.

Table 3.8-4 Covered Employment and Wages In Stillwater County, Montana-1989

	Number of Establishments	Average Annual Employment	Average Annual Wage
Agricultural Services, Forestry, and Fisheries	9	37	$14,369
Mining	6	436	32,277
Construction	18	41	18,736
Manufacturing	10	194	19,760
Transportation, Communications, and Public Utilities	8	40	23,523
Wholesale Trade	19	43	21,074
Retail Trade	38	231	10,900
Finance, Insurance, and Real Estate	3	20	16,258
Services	37	256	9,138
Government	27	329	17,424
Local	12	274	16,909
State	7	16	24,116
Federal	8	39	18,292
Unclassified	3	6	7,001
Total	178	1,633	$19,589

Source: Research and Analysis Bureau, 1990.

Table 3.8-5 Farm Statistics - 1982 and 1987

	Number of Farms		Average Size (acres)		Market Value of Agricultural Products Sold (average per farm)	
	1987	1982	1987	1982	1987	1982
United States	2,087,759	2,240,976	462	440	$65,165	$58,858
Montana	24,568	23,570	2,451	2,568	62,980	65,641
Stillwater County	447	429	1,885	2,012	58,637	55,500

Source: Bureau of the Census, March 1989 and May 1989.

3.8.5 Housing

The total number of housing units in Stillwater County increased by 22.8 percent between 1980 and 1990, compared to 10.0 percent for Montana. The Absarokee division absorbed a good portion of the expansion with a jump of 32.5 percent, but the Columbus and Park City divisions also recorded increases (20.7 percent for Columbus and 24.9 percent for Park City). The town of Columbus added 79 units to the housing stock, 13.1 percent above the 1980 level. The number of housing units in the Stillwater North division, the least populated in the county, contracted by 6.9 percent.

The housing market in Stillwater County is generally viewed as tight, particularly for rentals. The homeowner and rental vacancy rates in Stillwater County as of April 1, 1990 were 2.6 percent and 9.5 percent, respectively, slightly below the statewide vacancy rates of 2.9 percent for homeowners and 9.6 percent for rentals. These Stillwater County vacancy rates are not indicative of a tight market, but one possible explanation for this is that unoccupied seasonal, recreational, or occasional-use units make up an unusually large percentage of the vacant units in the county. Fully 55.7 percent of the vacant units in Stillwater County were in the seasonal, recreational, or occasional-use category compared to 37.2 percent for Montana. Thus, the vacancy rates for year-round units would be more in line with people's perception of the state of the real estate market than the statistics would indicate.

Those moving into Stillwater County to work at the mine have often had to accept temporary accommodations until something more suitable opens up. Included among the temporary arrangements have been renting vacation homes or mobile homes. Many of the in-migrants do not have the financial resources to purchase an existing home or build a new one, so there is a substantial amount of competition for the limited rentals which become available. Rents have, therefore, increased significantly according to those familiar with the real estate market in Stillwater County. Census data indicates that contract rents in Stillwater County rose an average of 5.9 percent per year over the 1980 to 1990 period compared to 4.3 percent for the state. Although the rate of increase in Stillwater County is not all that much higher than for the state, it seems likely that much of the increase in Stillwater County was concentrated in the last half of the decade.

Home prices in Stillwater County have been categorized as stable, and census data show that the median value of owner-occupied homes has not appreciated to the degree that rents have, increasing an average of 2.7 percent per year from 1980 to 1990. The relatively more stable housing prices are probably due to the previously mentioned concept that the demand for houses to buy is constrained by the limited financial resources of those moving into the community.

Actions taken by SMC to help employees find housing include the purchase and development of the Stratton and Circle T ranches. The Stratton Ranch was designed to provide temporary housing for employees in a mobile home setting until they were able to find more permanent accommodations. The first phase of the Stratton Ranch facility included 32 mobile home spaces, and SMC guaranteed the loans for employees to purchase the mobile homes. SMC plans to phase out the facility over the next 3-5 years. New occupants are no longer allowed to move onto the ranch, and when a mobile home is vacated, it is removed. Once all the mobile homes are removed, the area will then be reclaimed.

The Circle T Ranch was subdivided by SMC and employees can purchase the lots at a cost below what SMC has invested in the development. Apparently, the purchase price to the employee also tends to be less than the market value. Water, and power are provided to the lots, but individual septic systems must be installed. Of the 59 lots in the subdivision, 37 have been sold and 22 are still available for purchase.

3.8.6 Community Services and Facilities

The Hard Rock Mining Impact Act of 1981, as amended, requires new mining operations with more than 75 employees to formulate a plan which describes how the developer will mitigate adverse impacts on local governments. The plan indicates which local jurisdictions are affected by the mine development, an estimate of the impacts, a description of the mitigation measures and thresholds for when the measures would be triggered, conditions for an amendment, and provisions for monitoring.

In the case of the original Hard Rock Mining Impact Plan for the Stillwater Mine, which was signed in 1985 (SMC, 1985), and the 1988 amendment (SMC, 1988), which was triggered by an increase in the number of employees at the mine, the affected local jurisdictions were defined to include Stillwater County, the Town of Columbus, the Absarokee Rural Fire District, and school districts in Absarokee, Columbus, Fishtail, and Nye. Among the needs identified by these jurisdictions were additional personnel (e.g., for law enforcement, planning, social programs, schools, and road maintenance); greater funding for such items as court operations, libraries, mental health programs, and assistance to low-income individuals; and facilities and equipment (e.g., new schools, fire trucks). The plan establishes that SMC will provide mitigation in the form of tax prepayments, grants, and guarantees for the payment of principal and interest on educational impact bonds.

A significant amount of such financial assistance has already been provided by the SMC to the affected local jurisdictions, and the general impression one gets when talking to local officials is that the Hard Rock Mining Economic Impact Plan is working very well. Most people seem to feel that the financial mitigation has enabled the communities to better accommodate the growth which has occurred.

In spite of the mitigation, there are still concerns over the ability to provide services to the Stillwater County residents. The sewer system for the Town of Columbus is at capacity, and water lines in Columbus are in need of upgrading. The additional traffic from the population growth has resulted in unmet street maintenance needs, and it would be desirable to pave some of the gravel streets which have experienced greater traffic. With the hiring of additional law enforcement personnel, their office space has become inadequate. Emergency services, fire protection, and other services are generally considered to have improved with the implementation of Impact Plan.

March 31, 1991 enrollment figures for certain school districts in Stillwater County are shown in Table 3.8-6. In-migrating mineral development students are defined as students whose parent or guardian moved into the area to work at the mine. Compared to the period before the mine was developed, enrollment has increased in Absarokee, Columbus, and Fishtail elementary schools and Absarokee High School, while the student population fell at Nye Elementary and Columbus High School. In-migrating mineral development students accounted for the entire enrollment increases in the Absarokee schools, but were less of a factor in the expansion in the Columbus and Fishtail elementary districts. Absarokee accepts some students from other districts (e.g., Fishtail) on a tuition-paying basis.

As of the beginning of the 1991-1992 school year, enrollment at Nye and Fishtail elementary schools had declined somewhat from the previous year while little change was observed at the Absarokee schools. The Absarokee schools have a limited capability to absorb future increases in enrollment, particularly at the elementary level, but the Fishtail and Nye elementary schools could accommodate more students. The Columbus school system is at capacity at the elementary level, both in terms of class size and physical facilities. The junior and senior high schools are not as crowded, so increases in enrollment would not pose as big a problem as at the elementary level.

Table 3.8-6 Enrollment in Stillwater County Schools March 31, 1991

Elementary School Districts	Total Enrollment	In-migrating Mineral Development Students
Absarokee	259	78
Columbus	392	29
Fishtail	40	4
Nye	4	4
Total	695	115
High School Districts	**Total Enrollment**	**In-migrating Mineral Development Students**
Absarokee	132	36
Columbus	130	18
Total	262	54

Source: Stillwater Mining Company, March 31, 1990.

3.8.7 Attitudes, Beliefs, and Values

The Entercom report (1981) contains information on how people feel about living in Stillwater County and their perceptions about mine development. Although the survey on which the report is

based took place 10 years ago, before the development of the mine, many of the responses to the survey still seem relevant today. To summarize the results of the survey, the residents were satisfied with the quality of life in Stillwater County, citing the friendly people, the small population, and the physical attractiveness of the area as major advantages of living there. Disadvantages of living in Stillwater County, according to the respondents, included the lack of cultural/social activities, and limited shopping and employment opportunities. The disadvantage mentioned most often, however, was the condition of the roads.

With respect to mine development, residents viewed the major benefits as being greater job opportunities, a broader tax base, and a boost to the local economy. Concerns that were expressed about mine development included the potential for growth to occur too rapidly, the possibility that individuals moving into the area would be undesirable, the additional demands placed upon public services, and the effects on air and water quality.

Recent discussions with local residents, including local government employees, school officials, and business owners, indicate that, initially, the in-migrating mine workers and their families may have been perceived by some as "outsiders," but, over time, this attitude has become less prevalent. Unsolicited praise for the involvement of the new residents in community activities was offered on several occasions. On the negative side, certain landlords have apparently had problems with nonresidents who moved into Stillwater County to work at the mine, and some children of in-migrating mine workers, especially those who have come from another state, have experienced difficulties in adjusting to a new school system.

The March layoffs at the mine have resulted in the emergence of an additional concern among local residents. When the Entercom survey was conducted in 1981, residents felt that, if the mine were developed, the local economy would become more stable. There is now a concern that too heavy a reliance on the mining industry may have a destabilizing effect on the local economy and cause a number of problems which could potentially be avoided if the economy were more diversified.

3.8.8 Property Tax Base

One of the issues discussed in Chapter 1 is whether the mine has been responsible for increases in property taxes in Stillwater County over the past few years. Higher property taxes can be the result of an increase in mill levies, a rise in the taxable value of property, or a combination of the two. Special levies and school district levies cause total mill levies to vary according to the location of the property within the county, but information from the Montana Tax Foundation (1984) and the Stillwater County Assessor's Office (1991) indicate that levies applicable county-wide have risen from 157.87 mills in the 1984-1985 fiscal year to 201.85 mills for 1990-1991.

Although the levies for some of the individual categories have changed over this period (e.g., school levies rose after the removal of the freeze imposed by I-105), the increase is, in large part, attributable to a new levy of 40 mills which resulted from action taken by the 1989 Montana legislature. The purpose of the additional 40 mills is to equalize school funding, and the levy is applicable to every county in the state. Thus, it would appear that the increase in mill levies in Stillwater County is not related to the mine.

As indicated above, the amount of property taxes paid also depends upon the taxable value of the property under consideration. On an aggregate basis, the taxable value of property in Stillwater County is affected by, for example, the construction of new housing units as well as trends in the value of existing units. The taxable value of Stillwater County property totalled $19.5 million for fiscal year 1991-1992, and in constant dollar terms, is essentially the same as in the 1982-1983 fiscal year before the mine was developed. By contrast, the most recent published information for the state shows the taxable value of property in Montana actually declined by 33.2 percent between fiscal years 1982-1983 and 1989-1990.

The mine may be indirectly responsible for higher property taxes to the extent that any increases in house prices were caused by a rise in the demand for housing brought about by the development of the mine. Available data indicate, however, that housing prices in Stillwater County have increased at a rather modest rate over the 1980-1990 period, probably even less than the rate of inflation (see Section 3.8.5). Thus, it is likely that the development of the mine has had a negligible impact on housing prices, and the increase in property taxes in Stillwater County is due to other factors.

SMC is a significant source of property tax revenue to the county. The 1991-1992 property tax liability of the company is approximately $964,300. This includes the tax on the smelter in Columbus and the tax on that portion of the gross proceeds from the mine subject to property taxes. In addition, SMC pays a metal mines license tax to the state on the gross proceeds from the mine, and 25 percent of that is returned to the county. At least 40 percent of the county's share must be put in a reserve for use when the mine closes or a substantial reduction in employment occurs.

3.8.9 Mine Access Corridors and Use Patterns

In order to address the mine access, corridors and use pattern isses, it is necessary to review both the original EIS (DSL/FS) and the Eastside Amendment (DSL/FS, 1989).

1985 EIS

During the scoping effort for the Stillwater Project EIS (pg. IN-4), the public expressed concerns related to potential traffic volume increases due to implementation of SMC's Plan of Operations. These concerns include accelerated degradation of road conditions, impacts to the quality of life for Stillwater County residences who live along the heavily used access routes, and decreased safety while driving these access corridors.

The 1985 EIS for the Stillwater Project (pg. III-77 to 79) described pre-mine development use patterns for FAS 419, FAS 420, and FAP 78. Use of these access corridors was expected to increase due to implementation of SMC's Plan of Operation. It is important to note that use of these roads were expected to increase by 3.5% to 4.0% annually, even if implementation of the Stillwater Mine had not occurred. The traffic accident rate in the early 1980's on all the roads in the project area was significantly above the average for similar type roads statewide. The predominate reason for this situation was thought to be the poor alignment and conditions of the access routes.

Analysis contained in the 1985 EIS (pages IV-53 to 57), projected an increase in accident rates, increased road maintenance cost, and negative impacts to county residences living along the access corridors related to implementation of the company's proposal. It must be noted that the company's proposal did not mention any attempt on the company's part to reduce mine related traffic.

Mitigation aimed at reducing the mine related traffic impacts by 66% was prescribed via the 1985 Record of Decision (page 15).

1989 East Side EA/PER

The scoping effort for this document identified a number of concerns from both the public and the regulatory agencies (Chapter I, pg. 6). Most of these concerns related to potential traffic increases due to the development of the East Side Project into production. Additionally, the public expressed concerns related to SMC non-attainment of the previously prescribed 3.0 passengers/vehicle mitigation measure.

Analysis contained in the 1989 EA/PER indicated that the average daily traffic on FAS 419, FAS 420, and FAP 78 had increased since the mine became operational. On FAS 420 traffic volumes rose significantly (40%) from 1985 to 1987. Additionally, the accident rates for each of these roads were found to be generally above the statewide average for similar type roads.

Finally, the East Side EA/PER indicated SMC had made progress toward achieving the 3.0 passenger/vehicle mitigation, but that the goal had not yet been met. SMC requested relief from the mitigation measure via the East Side Amendment, however, the Decision Notice did not grant the request for relief. Additional mitigation was prescribed which required SMC to achieve compliance with the 3.0 goal prior to January 1, 1990. However, SMC employees living within 2 miles of the mine site would not be included in the calculation of the vehicle occupancy rate.

Table 3.8-7 indicates actual traffic volumes calculated by the Montana Department of Transportation on the major access corridors leading to the mine during the 10-year timeframe from 1980 to 1990.

<u>1991 2000 tpd Amendment</u>

Currently, SMC employs approximately 364 persons at the mine complex. The majority of these people live in the Stillwater County area and commute to work via either FAS 419, FAS 420, or FAP 78. However, as of March 31, 1991, 29 employees lived in Carbon County Montana which lies adjacent to Stillwater County. Additionally, approximately 50% of the employees listed in the "other" category (Table 3.8-8) reside in Carbon County. The use of FAP 78 and other rural dirt roads connecting Red Lodge (Carbon County) and the Stillwater Mine has not been analyzed in past permitting documents. Data supplied by the Montana Department of Transportation indicates that use of FAP 78 between Red Lodge and Roscoe has increased over the last 3 years. Some portion of this increase is attributable to the operation of the Stillwater Mining Company.

Table 3.8-7 Average Daily Traffic: FAS 419, FAS 420, FAP 78

Access	Years ---------->				
Route	1980	1987	1988	1989	1990
FAS 419	355	440	500	552	600
FAS 420	236	540	327	365	383
FAP 78	1,160	1,200	2,095	2,500	2,390

Currently SMC is in compliance with mitigation contained in both the Record of Decision (1985) and the Decision Notice (1989) concerning traffic reduction. These mitigation measures required that SMC reach an average of 3.0 passengers per vehicle by January 1, 1990. SMC has not only reached this goal, but exceeded it.

Table 3.8-8 Residence Area for Stillwater Mining Company Employees (3/31/91)

Columbus	54
Absarokee	130
Rural Stillwater County	132
Red Lodge	29
Other	19
Total	364

SMC has again requested relief, via the current amendment,from the mitigation measure aimed at mine traffic reduction. This is a result of SMC employee concerns raised during the scoping effort for this analysis. SMC has indicated that it may be an infringement upon the civil rights of their employees for the regulatory agencies to restrict the use of state and county roads.

It should be noted that FAS 419 is planned for upgrading from the junction of FAP 78 to the Stillwater Mine. Currently, bridge reconstruction is taking place near Fishtail, Montana. A portion of the project cost is being provided by the Stillwater Mining Company via the Hard Rock Economic Impact Plan.

3.9 Cultural Resources

The area involved in this proposed amendment has previously undergone extensive on-the-ground cultural resource surveys, and literature reviews. The results of these efforts may be found within the 1985 EIS for the Stillwater Project (Chapter III, page III-87), and the 1989 East Side EA/PER (Chapter IV, page 37). These documents are hereby incorporated by reference. If the reader seeks additional information related to cultural resource considerations within the project area, please refer to these documents. No sites are expected to be encountered.

CHAPTER 4 - ENVIRONMENTAL CONSEQUENCES

4.0 Introduction

This chapter discloses the potential impacts of each of the alternatives described in Chapter 2. Data and analyses from 1985 Stillwater EIS and the 1989 EA/PER were also incorporated into this analysis. The intent of this chapter is to provide the scientific and analytical basis for the comparison of alternatives in Chapter 5. The discussion in this chapter includes the environmental impacts of the alternatives including the company proposal's adverse environmental effects which cannot be avoided should the proposal be implemented, the relationship between short-term use of man's environment and the maintenance and enhancement of long-term productivity, and any irreversible or irretrievable commitments of resources. This chapter also includes a summary of the mitigation measures that would be required for the company's proposal and the other alternatives considered in the analysis.

4.1 Tailing Impoundment Construction and Operation

The tailing impoundment construction and operation has been described in detail in the original and amendment permit applications, and the 1985 Environmental Impact Statement. The impoundment has functioned essentially as designed with a few operational modifications.

The impoundment is designed to permanently store the fine fraction of mill tailing. The coarse fraction, which comprises the majority of the mill tailing, is physically segregated by cycloning, and hydraulically placed as backfill into previously-mined areas. The backfilled tailing "sand" is necessary to provide mining access to the ore. Not all of the mill tailing is suitable for use as backfill. The coarse fraction is relatively pervious, and when drained provides an adequate working platform within an acceptable time following hydraulic placement. The fine fraction, being less pervious, requires impoundment in a surface facility. Most cut-and-fill mining operations use only the sand fraction of tailing as backfill; that is, only particles larger than 200 mesh (U.S. Standard Sieve = 0.074 mm or 0.0029 inches) are segregated and placed as backfill. However, SMC uses considerably finer material for backfill. Particles larger than 325 mesh (U.S. Standard Sieve = 0.043 mm or 0.0017 inches) are segregated for backfill, and particles less than 325 mesh are slurried to the impoundment.

The metallurgical grind required for mineral recovery controls the particle size distribution of the mill tailing, and subsequently controls the percentages of the mill tailing that can be segregated for use as backfill or must be deposited in the impoundment. Presently, the metallurgical grind provides about 93 percent of the coarse fraction tailing for required backfill volumes, and additional material must be crushed to supplement the backfill sand. This requirement is met operationally by diluting the ore feed to the mill with waste rock (about 10 percent by weight). The metallurgical grind and the waste rock supplemented for sand presently results in 38-40 percent of the total mill tailing being deposited in the tailing impoundment.

Milling started in March of 1987. The operation to date has produced about 1.3 million tons of ore, and the tailing impoundment contains about 600,000 tons of saturated fines. The impoundment embankment is being constructed by the downstream method of sequential raising. Unlike water impoundment structures, tailing dams can be constructed in stages due to the slow rate

of filling. Downstream construction is the most stable method of tailing dam construction (compared to centerline or upstream construction), and is generally considered applicable for impoundments subject to seismic probability, or impoundments with impervious foundations that are unable to minimize ponded water levels. The present impoundment has been constructed to Stage 2; the dam crest elevation is 5,080 feet above sea level, maximum height is about 110 feet, maximum Stage 2 storage capacity is 2.3 million cubic yards of tailing, and the tailing surface will cover 33 acres in the year 2002 at projected filling rates.

Some construction modifications have occurred that vary from the original preliminary engineering design work published in 1986. The design modifications were approved as final engineering reports, as-built construction reports, or permit amendment.

The most substantial variation from the preliminary engineering design occurred during construction of the initial (Stage 1) embankment. At that time, it was determined that the permitted upstream, or inside slope of the dam at 1.6h:1v was too steep to effectively prepare the foundation and place the liner. The upstream slope was subsequently constructed at 2h:1v, resulting in an extension of the downstream toe. Because of the location of the existing toe dike, and the future construction stages with 2h:1v slopes on both the upstream and downstream dam faces, the final permitted elevation of the dam would be limited to 5,111 feet above sea level. The original permitted elevation of 5,102 would have allowed an additional lift, if necessary, before the slope of the dam coincided with the slope of the toe dike. The operational modification of flattening the upstream dam face resulted in better foundation preparation and liner placement, and an increase in the ultimate permitted dam elevation from 5,102 feet to 5,111 feet above sea level. The modification also precluded any future expansions within the limits of the existing toe dike.

During construction of the Stage 2 embankment expansion, the toe dike was extended on the west side to intercept and divert a 68-acre drainage above the tailing impoundment. This extension and diversion reduced flood storage requirements in the impoundment and justified the elimination of an operational spillway.

Stage 2 embankment construction encountered a tight spot in the area of the truck shop building on the north side of the embankment. A retaining wall and subsequent embankment lifts at 1.5h:1v were implemented in order to avoid relocation of the truck shop during operations. Following removal of surface facilities, the affected portion of the dam flank would be backfilled to achieve the permitted 2h:1v reclamation slopes.

The need for additional material required for backfill volumes was identified and permitted with Amendment 005 - East Side Expansion. Original metallurgical bench testing and material balance estimated that 65 percent of the mill tailing could be used for backfill and the remaining 35 percent would be impounded. However, the finer grind necessitated for metallurgical recovery has resulted in less coarse tailing available for backfill and more fine tailing being impounded. The increased fine fraction of mill tailing being slurried to the impoundment, and the generation of additional fines by the processing of waste rock to supplement sand backfill requirements results in a slightly increased rate of tailing deposition and a corresponding reduction in total ore production and impoundment life.

Reclamation contours for the tailing impoundment surface were revised with Amendment 005. The original permit specified a dome in the middle of the impoundment to direct precipitation runoff radially away from the reclaimed surface. The revised permit specifies that the impoundment surface will be backsloped from the impoundment crest to route runoff away from the dam slopes and toward diversions on the western open end of the impoundment.

4.1.1 Environmental Consequences of Impounded Tailing

The existing tailing impoundment, and modifications resulting from the company's proposal and other alternatives being evaluated by the agencies, have environmental consequences that are similar for all potential actions, as well as consequences that are unique to a particular course of action. Geotechnical consequences that are relatively similar for all impoundment scenarios being considered include effluent seepage, liner degradation, and self-weight consolidation of the impounded tailing mass. Examples of environmental impacts and geotechnical issues that are unique to a particular impoundment action include relative impoundment stability, material balances, flood plain intrusions, equipment limitations, and filter compatibility of construction and reclamation materials.

4.1.2 Geotechnical Issues and Environmental Consequences Common to All Potential Impoundment Actions

The issues of effluent seepage, liner failure and self-weight consolidation of the tailing mass, and the environmental consequences that may result are relatively common to all the potential impoundment actions being evaluated. The consequences related to these issues would range proportionally with the size of the impoundment. For example, the impounded tailing mass for all actions being considered would range between 3.5 million tons and 5 million tons.

Tailing effluent seepage would occur during the life of the impoundment and for a period of time following closure. Tailing effluent seepage is controlled by the low permeability of the 100-mil HDPE synthetic liner, and to a lesser extent by the tailing mass. The relatively pervious foundation is considered to have negligible influence on impoundment seepage. In other words, any quantity of seepage that passes the liner would be easily carried by unsaturated flow in the pervious foundation.

The impounded tailing fines, also technically referred to as slimes, are segregated as cyclone overflow and slurried to the impoundment at a pulp density of 14 percent solids. At the given pulp density, the slurry contains more than 17 times the volume of water than the volume of solids. The non-plastic solid particles settle out of the slurried suspension rapidly, allowing cleared effluent to be available for decantation and recycle at the mill. The slurried method of deposition and lined foundation cause the sedimentated tailing to be saturated to super-saturated at all times. During normal operations, the impounded tailing is covered by an average of two feet of water.

Seepage of tailing effluent through the synthetic liner can occur by permeation and by flow through defects.

The synthetic liner prevents fluid flow through the liner, but water can permeate the synthetic liner by vapor transmission. It has been estimated that permeation can account for seepage of 0.02

gpm for as long as the tailing mass is saturated, assuming an equivalent liner permeability of 1×10^{-13} cm/sec and a permeability of the tailing slimes of 5×10^{-6} cm/sec. The seepage due to permeation could account for about 31 gallons per day, or approximately 11,000 gallons per year. However, it is believed that the phenomenon of permeation and the associated phase changes from liquid to vapor results in distillation of the effluent. Therefore, the seepage volume due to permeation would not contain the dissolved chemical constituents of concern that are measurable in tailing impoundment water.

Fluid flow through liner defects was simulated for the 100-mil HDPE liner at the East Boulder project by assuming that defects in liner welds and punctures reduced the overall equivalent permeability of the liner to 1×10^{-12} cm/sec. The average permeability of the liner/tailing system can be shown to be 8.5×10^{-9} cm/sec, resulting in a seepage rate of 0.22 gpm. The seepage due to fluid flow through liner defects under tailing could account for approximately 317 gallons per day, or 116,000 gallons of tailing effluent per year.

Liner defects in areas that are covered by ponded effluent can contribute greater flows than areas that are covered by tailing fines, as the low permeability of the tailing mass impedes flow to the defect. At an average ponded depth of two feet of effluent above sedimentated tailing, approximately one acre of liner is exposed to unimpeded fluid flow through defects. Assuming a conservative standard defect of a 1/8-inch diameter hole per acre, the unimpeded flow through the liner area under ponded effluent can be estimated to be 0.26 gpm. The seepage due to fluid flow through defects under ponded effluent could account for 375 gallons per day or 137,000 gallons per year.

The total estimated seepage rate due to permeation and fluid flow through defects can be estimated to be 0.5 gpm over the majority of the life of the impoundment, and for some time after deposition until equilibrium and steady state seepage conditions are reached. The estimated annual seepage volume of 263,000 gallons is insignificant when compared to the approximately 537 million gallons of effluent that are annually slurried to the impoundment at present production rates (about 4 parts per million lost to seepage). This seepage is included in the water impact analysis discussed in Section 4.2 of this chapter. However, given the wide range of variables and assumptions, and the theoretical level of current research, any attempt to predict seepage flow through the synthetic liner can be viewed with skepticism.

Based on the chemical constituents of the tailing effluent, a drastic loss of tailing effluent over a period of time would be required to measurably affect the quality of groundwater and surface water resources in the area. It is important to note that most flotation tailing impoundments are unlined facilities that are built on pervious foundations, and are designed to leak. The SMC impoundment is unique in both the relatively innocuous quality of the tailing impoundment water and that it is a lined facility.

Monitoring for seepage includes impoundment piezometer readings, downgradient wells that are checked for water level and water quality changes, and daily observation of process water flow rates and balance. None of these monitoring systems have detected any evidence or effect of seepage from the impoundment.

Deterioration and degradation of the liner would occur over the long term, but it is anticipated that eventual failure of the liner would occur after operations and reclamation. Liner failure can be assumed to be gradual, and subsequent dewatering of the tailing mass can be assumed to be distributed over a period of time. It is estimated that the fine particle size distribution and ultimate consolidated density will result in the majority of the saturated volume being retained in the tailing mass. Published data on deposits of similar mineralogy and size distribution indicate that the tailing mass will retain about 78 percent of its saturated volume under gravity drainage, while yielding about 22 percent of its saturated volume. At an ultimate impounded mass of 3.5 million to 5.0 million tons, the eventual draindown following liner failure would range from 67 million to 96 million gallons.

Self-weight consolidation of the tailing will occur throughout the depositional life of the impoundment, and during and after reclamation. Consolidation will result in an increased average density and a reduction in volume. Consolidation of the tailing mass will cause settlement and depression of the surface.

The proposed method of bulldozing the tailing surface to effect the required reclamation gradient is impractical, given the fine particle size distribution of the tailing slimes and saturated conditions. In addition, the high specific retention of the material will likely limit the effectiveness of attempts to dewater the top of the tailing mass, and surficial desiccation will likely not provide the bearing strength necessary to access the tailing surface with reclamation equipment.

Reclamation access will probably require placement of filter fabric and geonet ahead of an advancing structural cap of waste rock. The final thickness of the cap will be dependent on the required bearing strength of the surface and the degree of consolidation and resulting settlement that will control the ultimate post-reclamation contours.

Preliminary engineering studies on metallurgical bench test tailing have indicated that the material consolidates rapidly (coefficient of consolidation, C_v = 2400 ft^2/year). The projected degree of consolidation at closure is high, and the remaining settlement due to primary consolidation and surcharge (waste rock cap weight) consolidation is projected to be minimal, at about 1.5 percent of the deposited thickness. Follow-up studies that involved surveyed pond volumes and known deposited tonnages indicate that the initial stages of deposition have behaved as predicted, based on increasing average dry densities due to self-weight consolidation with depth.

The level of engineering testing and incorporation of consolidation and settlement data into the reclamation proposal of the SMC impoundment surface matches or exceeds present industry standards. However, the projections must be considered optimistic and preliminary. Numerous variables preclude accurate prediction of ultimate consolidation and settlement. Metallurgical bench test models may not accurately represent the behavior of a 5-million-ton prototype. Depositional irregularities can cause variable response throughout the impoundment. Operational modifications, exemplified by the finer mill grind required for metallurgical recovery, can alter ultimate conditions.

The consequences of underestimating ultimate settlement would include an inability to sustain the required reclamation gradient, subsequent precipitation recharge and saturation of the tailing mass and cap materials, and vegetative failure. Given the strict construction specifications for the

reclamation cap, the unknowns associated with the bearing strength, degree of consolidation and settlement rate of the tailing mass, and the potential omission of final engineering analyses of the actual tailing mass at closure, it is anticipated that the proposed reclamation of the tailing surface has a marginal probability of success.

4.1.3 Geotechnical Issues and Environmental Consequences that are Unique to the Tailing Impoundment Alternatives Being Evaluated

The company's proposal and the reasonable alternative actions that are being evaluated have issues and consequences that are unique to the action. The geotechnical issues relating to the alternative actions include relative impoundment stability, material balances, floodplain intrusion, equipment limitations and filter compatibility of construction and reclamation materials.

4.1.3a Tailing Impoundment Alternative 3a, No Action

With the no-action alternative, production would continue at 1,000 tpd, and the staged development of the impoundment would continue as permitted; 2h:1v downstream slopes and an eventual crest at elevation of 5,111 feet.

Production at the present rate of 1,000 tpd would fill the impoundment to the 3.5 million ton capacity in 22 years, approximately at the end of the year 2013. During this period, a total of 9.2 million tons of ore would be produced and development would result in surface disposal of 4.6 million tons of waste rock.

Essentially all of the development waste rock would be used by the end of the project and no permanent waste rock storage and dump reclamation would be anticipated. Most of the waste rock would be used in dam construction; other uses of significant quantities of waste rock include sand tailing supplement for backfill, miscellaneous facilities construction and reclamation.

Stability analyses for the ultimate permitted impoundment indicate that a minimum factor of safety of 1.8 exists for the long-term static condition and a factor of safety of 1.3 exists for the pseudostatic (seismic potential) condition. These factors of safety are considered to be well above the minimum acceptable factors of safety recommended by the U.S. Army Corps of Engineers and adopted as design criteria by SMC. Minimum acceptable factors of safety are 1.5 for static conditions and 1.0 for pseudostatic (seismic potential) conditions. A factor of safety of 1.0 suggests that a structure has an equal probability of failing or remaining stable under given conditions. A minimum static factor of safety of 1.5 is considered by the industry in general to be necessary and reasonable, given that analyses consist of empirical modelling, and the potential hazards of failure deserve less than equal odds of occurring. A minimum pseudostatic factor of safety of 1.0 is generally considered appropriate because of the low probability of occurrence of the design seismic event.

Structural damage or failure could be induced by the design flood events. Original baseline studies demonstrated that the one-half Probable Maximum Flood (PMF) would peak about 4 feet above the base of the toe dike, and subsequent erosion could cause structural damage to the embankment. The occurrence of the full PMF may or may not be sufficient to cause failure of the dam, but damage

to the embankment was determined to be insignificant compared to regional damage from the full PMF.

Failure of the SMC embankment due to mass instability or flood damage could result in the release of about 3.5 million cubic feet (26 million gallons) of ponded water, if failure occurred during the operating life. The tailing mass itself has some internal shearing strength and would not be expected to flow. Total failure of the dam after reclamation could cause long-term mobilization and distribution of the tailing by wind and water erosion.

4.1.3b Tailing Impoundment Alternative 3b, Company Proposal

SMC has proposed to increase the daily production rate to 2,000 tons, and revise the remaining stages of tailing impoundment construction to increase storage capacity and impoundment life. The embankment crest would be raised 14 feet from the permitted elevation of 5,111 feet to an elevation of 5,125 feet. The ultimate tailing elevation would be increased 19 feet from the permitted elevation of 5,102 feet to an elevation of 5,121 feet. In addition to raising the dam height, the downstream slope of the dam would be constructed and reclaimed at 1.6h:1v so that the final slope of the dam would coincide with the slope of the existing toe dike.

The company's proposal would increase the capacity of the impoundment from 3.5 million tons to 5.0 million tons of tailing. The ultimate capacity would allow production of 13.2 million tons of ore. The life of the impoundment would be 17 years, through the year 2008, at a 2,000-tpd production rate.

Development and disposal of 6.6 million tons of waste rock would be associated with production of 13.2 million tons of ore. The majority of the waste would be used in dam construction, sand tailing supplement for backfill, facilities construction and reclamation. An estimated 623,000 tons of waste rock would require permanent storage and dump reclamation.

Overall stability of the proposed impoundment would be less than the permitted impoundment. Stability analyses for the proposed impoundment indicate that a minimum factor of safety of 1.5 exists for the long-term static condition and a factor of safety of 1.1 exists for the pseudostatic (seismic potential) condition. The static factor of safety of 1.5 is equal to the minimum acceptable factor of safety, and the pseudostatic factor of safety is slightly greater than the minimum acceptable design criteria. The analyses suggest that the proposed expansion and modification of the tailing impoundment may be approaching the limit of prudent engineering. However, the analyzed stability meets U. S. Army Corps of Engineers and industry standards and the analytical assumptions are reasonable and acceptable.

Structural damage or failure of the impoundment due to flood potential would be unchanged by the company proposal. The final stage of construction is designed to incorporate the existing toe dike into the permanent slope; therefore, there would be no downstream extension of the final dam toe. The one-half PMF flood would cause erosion of the dam toe and the full PMF may cause failure of the embankment.

Reclamation of the 1.6h:1v dam slope is proposed as armoring with selected coarse waste rock. The proposal varies from the permitted reclamation of a 2h:1v dam face by exchanging questionable vegetative productivity for long-term stability. If properly constructed, it is anticipated that the steep armored dam face would have much greater resistance to the erosional forces of precipitation runoff and wind than a somewhat less steep vegetated dam face. Proper construction of the final dam face would require filter compatibility between the riprap and the embankment construction material. The proposed use of available coarse waste rock does not meet all filter criteria, and piping of embankment fines would likely occur during precipitation runoff events. Due to the extreme thickness of the base, in this case the dam construction materials, erosion by piping would not be a threat to the structural stability of the dam. However, piping of embankment fines could result in localized channeling of runoff, potential minor slumping of armor and deposition of alluvial fines at dam toe discharge points.

The environmental consequences of filter incompatibility would be minor, but if a localized problem developed, repair of the slope would be extremely difficult or impracticable. Slopes of 2h:1v are considered the maximum gradient for operation of construction equipment, and operation is limited to crawler tractors in one direction - parallel to the slope. In addition to the uneven traction of a riprapped surface, the extreme gradient of the proposed slope would preclude any remedial reclamation efforts.

4.1.3c Tailing Impoundment Alternative 3c, Partial Approval

The partial-approval alternative would allow the company to expand production and milling facilities to accommodate a 2,000-tpd production rate without modification of the permitted tailing impoundment. The impoundment would continue to be constructed in stages to a final crest elevation of 5,111 feet and final downstream slopes on the dam face at 2h:1v.

Phased increase of production to 2,000 tpd would fill the tailing impoundment to the permitted 3.5 million ton capacity in 12 years. Production of a total 9.2 million tons of ore would continue through the year 2003.

Essentially all of the 4.6 million tons of development waste rock would be used in dam and facility construction, sand tailing supplement for backfill, and reclamation.

The staged construction of the embankment would be unchanged, and the analyzed stability factors of safety would remain well above the minimum acceptable criteria.

Structural damage or failure due to flood potential would be the same as the no action alternative or the company proposal. The existing toe dike face would be incorporated into the final reclaimed slope. The one-half PMF flood would reach the dam toe and cause some erosion and structural damage. The full PMF may cause failure of the embankment.

4.1.3d Alternative 3d — Modified Tailing Impoundment

Approval of the company's proposal with modification would enable SMC to increase production and processing facilities to accommodate a mining rate of 2,000 tpd. Tailing impoundment expansion to the proposed crest elevation of 5,125 feet would be allowed to increase storage capacity and impoundment life. The proposed staged construction would be modified to maintain 2h:1v downstream dam face slopes during operation and reclamation. The construction of the dam face at 2h:1v rather than 1.6h:1v would cause a downstream extension of the dam toe, and the existing toe dike would be buried by the final stage of construction. Reclamation of the dam face would remain as permitted; that is, soil covered and revegetated.

The tailing impoundment expansion would allow deposition of 5.0 million tons of tailing and production of 13.2 million tons of ore. At a phased incrementation to an eventual production rate of 2,000 tpd, the tailing impoundment capacity would suffice for 17 years of operation, through the year 2008.

Most of the 6.6 million tons of development waste rock would be used to build the larger, modified embankment. Additional waste rock requirements for facilities construction, sand tailing supplement for backfill, and reclamation would exceed the projected available waste rock. Therefore, an additional borrow source would have to be developed to provide an estimated 470,000 tons of construction material.

Stability analyses have not been performed for the modified embankment. Construction of the embankment at 2h:1v would require that the volume of the embankment contain 15 percent more construction fill than the company proposal of a 1.6h:1v downstream slope on the embankment. Although the comparison of stability is not directly proportional to embankment volume, all other parameters affecting stability are equal and the larger modified embankment would have greater factors of safety under both long-term static and pseudostatic conditions. It is presumed that the mass stability of the modified embankment would exceed minimum acceptable criteria.

Construction of the ultimate embankment downstream slope at 2h:1v would bury the existing toe dike. The modified dam toe would extend a maximum of 62 feet and an average of 55 feet toward the Stillwater River. Supercritical flows from the one-half PMF flood would reach about 10 feet above the base of the dam, and extensive erosion and structural damage would be expected. The probability of total failure with the occurrence of the one-half PMF or full PMF flood events would increase substantially with this alternative.

Alternative 3d would also require modification or relocation of FAS 419.

Cumulative Effects of Tailing Impoundment Alternative

Since neither Chrome Corporation of America nor International Platinum operations are reasonably foreseeable, no cumulative effects are expected from these sources.

If favorable economic conditions prevail in the future, SMC may fill the present impoundment before they exhaust their ore reserves. In that case, a new proposal would be required which would initiate another NEPA/MEPA process. Some cumulative effects would probably occur because of an overlap of construction and initial operation of the new facility and reclamation of the present one. But, as was discussed in Section 2.7.3 of this document, due to the large number of variables in the economic environment, it is impossible to predict if a new impoundment would or would not be built. It is also impossible to analyze in any meaningful way impacts from a theoretical impoundment because of the almost infinite number of technical and environmental variables.

4.2 Water Resources

4.2.1 Hydrologic Consequences of the Alternatives Being Considered

The project is currently permitted to develop and produce about 9.2 million tons of ore, based on the 3.5 million ton capacity of the tailing impoundment. To date, development has resulted in 1.7 million tons of waste rock and the production of 1.3 million tons of ore. Ongoing production and development would result in larger discharges of adit water due to groundwater interception by mine openings.

The company's proposal would result in the production of 13.2 million tons of ore and an associated 6.6 million tons of waste rock. Operational discharge of mine water has been estimated by SMC to eventually be 789 gpm of which 700 gpm would be due to groundwater inflow. The average steady state groundwater flow of 700 gpm would continue after operations as permanent groundwater interception and discharge.

The company estimate of 700 gpm of ultimate groundwater flow into the mine is considered to be optimistic. The mine is presently at about 26 percent of the required development and has produced only 10 percent of the proposed ore. Groundwater intercept predictions of both the original EIS (December, 1985) and the East Side Expansion environmental assessment (Amendment 005, December 1988) were exceeded early in the life of the project. Therefore, an estimated increase of ultimate steady-state groundwater inflow to 700 gpm from the present average of 500 gpm may be unrealistically low.

The estimated discharge of 789 gpm may be reasonable during operations because groundwater inflows can be slowed by grouting and excess water intercepted by mine openings can be incorporated into project water consumption and balance. However, ultimate and permanent groundwater inflows and discharge will likely exceed the estimated operational discharge of 789 gallons per minute. Grouting techniques can be effective in obstructing flow paths and reducing groundwater flow volumes, but grouting is a partial and temporary reduction of long term groundwater flows. The viscosity of grout precludes pumping to any appreciable distance or into extensive fracture systems. Mining-induced stress field changes and subsequent distressing will fracture grout and grouted rock mass, particularly during the late stages of mining and the period of post-mining convergence.

The extent of development required to access ore will directly affect the amount of water-bearing structural intercept and groundwater flow into mine openings. Underground development is necessarily ahead of production, particularly given that the SMC project is essentially in the start-up phase. Existing development is believed to have already dewatered major structure to steady state discharge levels. The relatively shallow depth of the mine workings below surface and the recognized groundwater connection to surface recharge systems controls the probability of future groundwater intercept. Development of laterals, cross-cuts and raises above and below the existing developed levels would not be expected to intercept water-bearing structure that has not been previously encountered. However, the extension of development to the east and west of existing levels would be expected to intercept water-bearing structure at a rate and volume proportional to that experienced during previous development.

The Stillwater project has about 12,000 feet of strike length developed for production access. The amount of available ore reserves within the developed strike length is unknown. Given the variability of ore grade mineralization and low extraction ratios (stoping extent in the ore plane) experienced on the west side, and the relatively consistent and narrow width of the ore-bearing zone, it is estimated that existing development may not be sufficient to support access to the permitted production of 9.2 million tons of reserves. Similarly, the proposed production of 13.2 million tons of ore will likely require east and west extension of present development, and the intercept of additional water-bearing structure and increased steady state groundwater flows can be anticipated.

The intersection of water bearing structure with east and west extension may not decrease as development proceeds farther into the mountains. Overburden above mine openings would be as much as 3,000 feet on the lower levels and as little as 50 feet in the stoping crown pillars. The considerable geologic deformation in the Stillwater Complex and the inflow conditions that have been experienced to date indicate that water bearing structure beyond present development would probably have connection to surface recharge sources.

Production zones can potentially contribute to groundwater inflow and discharge. Most groundwater has been encountered in development openings. However, stoping is permitted to within 50 feet of the surface and the fractured crown pillars are expected to result in hydraulic conduits for surface water recharge. Stopes that are mined to within 50 feet of the surface could result in groundwater flow through pervious sandfilled production zones. In addition, the proposed increase in production will create about 10 times the volume of backfilled voids that exist today, and at least minor groundwater inflows in these areas could be expected to contribute to permanent discharge.

The original EIS (December 1985) was accurate in the assessment that groundwater flows in the fractured bedrock system would be impossible to predict. Unknowns with regard to ore plane mineralization, ore reserves, development requirements and fracture location will continue to preclude accurate anticipation of groundwater flow into mine openings during future operations and after closure. However, a range of ultimate and permanent groundwater discharge volumes can be estimated by using known discharge volumes, existing and ongoing monitoring data, and projected material balance quantities. A conservative estimate of 1900 gpm may ultimately and permanently discharge as steady state groundwater flow into mine workings, assuming the present to proposed ore

and waste rock volumes, and the developed strike length and extraction ratios required to produce 13.2 million tons of ore.

The proposal to expand tailing impoundment capacity to accommodate production of 13.2 million tons of ore would result in permanent steady state groundwater flow into underground mine openings and subsequent adit discharge of 700 - 1900 gallons per minute. Surface water resources in the area will probably be impacted by the altered groundwater system. Groundwater flow through natural bedrock systems will increase when the mine openings are connected to surface water recharge sources by fractures. Stoping to within 50 feet of the surface will create a cone of depression and drawdown for area groundwater, and will likely impact surface water resources in local areas.

The anticipated increased groundwater flows into mine openings would have little affect on operational or post-operational water quality. Groundwater drawdown and surface water recharge of fractured crown pillars above stoping zones may affect water quality to some degree. The movement of groundwater through stopes backfilled with tailing and along the stope and rib pillar boundaries in the mineralized plane could result in discharge of dissolved metals.

Alternative 4a, No Action

Groundwater interception and discharge from existing development and projected mining and development of 9.2 million tons of ore would result in permanent flows that could range from 500 to 700 gpm.

Alternative 4b, Company's Proposal

Groundwater interception and adit discharge from the proposal to develop and mine 13.2 million tons of ore would result in permanent steady-state flows that could range from 700 to 1,900 gpm.

Alternative 4c, Advanced Treatment

Under the advanced treatment alternative, groundwater interception and permanent adit discharge rates could range from 500 gpm to 1,900 gpm, depending on the development and production of 9.2 to 13.2 million tons of ore.

4.2.2 Water Quality

Certain aspects of the existing facility and proposed expansion will be similar under each of the Alternatives considered. These consequences will be considered in this section before the more detailed Alternatives analyses are presented in subsequent sections.

Runoff and Sediment Control. Under all of the alternatives considered, additional construction activities would surfically disturb soils on both sides of the Stillwater River. The removal of the

ground surface would result in temporary increases in runoff and erosion. While there would be an increase in erosion, the amount of sediment reaching the Stillwater River would be minimal.

In anticipation of the new Stormwater Regulations, SMC has instituted a surface water management plan using diversion ditches and catch basins upgradient of the Stillwater River. These structures are designed to be zero discharging under normal precipitation events. SMC will be required to obtain a Stormwater permit and monitor any discharge after Stormwater regulations are adopted by the DHES.

Spills and Pipeline Ruptures. Possible spills from fuel tanks or chemical stock piles could impact groundwater. If these spills were to occur, impacts would be greatly reduced due to the presence of concrete containment pads beneath the storage areas.

All alternatives include 4-6 pipelines crossing the Stillwater River. Rupture of these lines would result in several hundred to several thousand gallons of material being discharged before shut-down of equipment would occur.

All pipelines crossing the Stillwater River are enclosed in a steel containment vessel which is designed to route spilled material to a spill containment pond located on the east side of the river. The containment vessel is equipped with moisture sensors which would trigger alarms at the mill control center. The containment pond has the capacity to handle the spilled material until shut-down of affected circuits. SMC has developed a Spill Prevention and Response Plan to address this potential situation.

Tailings Impoundment and Mill Facility. From a water quality impacts perspective these facilities are similar under all the alternatives. The reason for this is that the mill and impoundment are zero-discharging facilities. That is, no discharge of process water to surface or groundwater occurs from either of these structures. Process water is recycled through the mill circuit with adit water being used to supplement process water when necessary.

The 100-mil HDPE impoundment liner is unique in that it is used with flotation tailings. Seepage from the impoundment is considered inconsequential. Tears or improperly sealed seams may have an adverse impact on groundwater; however, downgradient monitoring wells would detect such a leak before significant impacts could occur.

The impoundment is designed to contain the probable maximum flood event, excess tailings, and three feet of freeboard. Therefore, it is unlikely that any storm event would overtop and/or breach the impoundment embankment.

Septic System and Drainfield. Any water supply or wastewater disposal system that serves 25 or more people daily is defined as public system and must submit plans and specifications to the DHES for approval prior to construction, alteration or extension (ARM 16.20.401 et seq.). Wastewater systems must conform to DHES standards set forth in Circular No 84-10. Septic systems designed and operating to these specifications are considered to be applying secondary treatment.

The existing drainfield was approved in December 1986 by the DHES. SMC would be required to submit an engineered design for expanding the existing system if the amendment were approved by the agencies.

It is estimated that a drainfield designed for 525 people would add approximately 2.6 and 0.35 pounds per day of nitrogen and phosphorus, respectively, or twice the amount existing in the soil. Impacts would be distributed between the enlarged west side drainfield and a new east side drainfield. Based on the depth to groundwater, and transmissivities of the underlying aquifer it is qualitatively assumed that impacts would be minimal.

Water Quality Standards and Impact Analyses

Both DHES and EPA have standards that apply to surface and groundwater discharges. These include both water quality-based and technology-based standards. Numeric standards and nondegradation are designed to protect human health and aquatic life by limiting the increase in concentration of certain harmful substances. Technology-based standards, when applicable, specify the degree of waste water treatment considered appropriate for surface water discharges.

The DHES is responsible for implementing sections of the Federal Clean Water Act under delegated authority from EPA. Montana has adopted EPA's Water Quality Criteria (EPA, 1986) for surface water which includes numeric criteria for the protection of human health and aquatic life. Montana water quality standards also contain narrative criteria, such as ARM 16.20.633(1)(e), prohibiting the discharge of substances which produce undesirable aquatic life.

Montana surface water quality standards also require that industrial wastes receive, as a minimum, treatment equivalent to best practicable control technology currently available (BPCTCA), or, the equivalent of secondary treatment (ARM 16.20.631). Montana BPCTCA incorporates by reference Federal treatment standards as defined in 40 CFR Subchapter N whichspecifies effluent limitation for mining and milling discharges (see Glossary for definition of discharge).

Montana has also promulgated groundwater standards pursuant to the Montana Water Quality Act (WQA). These standards also contain numeric criteria and nondegradation provisions. Groundwater rules do not contain technology-based treatment standards except those defined in the Water Quality Act (MCA 75-5-303) for nondegradation. Maximum Contaminant Levels (MCL: ARM 16.20.203) are concentrations of organic and inorganic chemicals developed for public water supplies and are applied to groundwater for the protection of human health. Nondegradation applies to those parameters which have MCL's, or any constituent that may adversely affect beneficial uses.

Impacts to surface and groundwaters in the following sections are calculated through the use of loading analysis. Loading analysis estimates the increased mass or load of constituents (metals or nutrients) in a receiving water when the discharge from the proposed action is added. The results are reported as concentration, that is, milligrams per liter (mg/L). The results are presented along with the applicable numeric criterion which is also expressed in mg/L.

A number of uncertainties are inherent in this type of analysis. It is assumed that the quantity of ambient and discharge water is exactly known and mixing is instantaneous and complete. It is also assumed that the exact value of each parameter in the equation is known. However, the value is often below the analytical detection limit (denoted with a less than "<" symbol). In these cases, the actual analytical detection limit is used in the calculation. Finally, no attempt has been made to calculate the amount of attenuation that would occur in both soil and groundwater. These processes are well known and do result in some removal of nutrients and metals.

In each case, conservative assumptions are made involving these uncertainties. Therefore, loading analysis tends to overestimate the impacts of the proposed discharge.

Impacts to groundwater are based on dissolved metals. This procedure involves passing the sample volume through a filter (0.45 microns) in the field before acidifying the sample. Particulate material is retained on the filter and discarded. Surface water analyses are based on an unfiltered sample and expressed as total recoverable metals.

Actual surface water discharge could take place under the terms of an MPDES permit which would specify limits based on either a technology based limit, such as for total suspended sediment (TSS), or water quality based limit, such as for nutrients and metals. Actual effluent limits would be developed after the BHES ruled on the petition. It would be SMC's responsibility to provide any additional treatment necessary, prior to discharge, to meet these standards. Violation of these effluent limitations would result in enforcement action by the DHES.

Total dissolved solids, ammonia, nitrate, chromium, copper, iron, lead, manganese, nickel and zinc are included in the petition and analyzed for each alternative since the concentration of these parameters is greater than the ambient concentration in the Stillwater River. Total dissolved solids, nitrate, chromium, and lead are included in the groundwater portion of the petition and are analyzed along with the other metals.

Parameters not included in the petition include cadmium, arsenic, mercury, beryllium and silver, although cadmium and mercury are specified in the MPDES permit. The concentration of cadmium in the adit water is lower than ambient surface and groundwater concentrations. Arsenic, mercury and beryllium are not included since they are not present in the ore body based on geochemical sampling (SMC, 1991a). Silver is slightly elevated in the ore body but is limited by extremely low solubilities. These predictions have been confirmed through sampling of the adit water and analysis at extremely low detection limits by both SMC and the agencies.

For the purpose of analyzing surface water impacts to the Stillwater River, average and low flow values were determined from USGS Gaging Station (06202510) located above Nye Creek. The low flow was determined from the 7-day, 10-year low flow, as required in ARM 16.20.703. The average and low flow estimates are 367 and 31.1 cubic feet per second (cfs), respectively. For comparative purposes the current SMC discharge is 500 gpm (1.1 cfs) and would increase under the proposed action to 789 gpm (1.7 cfs).

Groundwater dilution estimates were derived from observed nitrate concentration in monitoring wells (MW-12A, 13A, & 15A) during March through May 1991 when the SVR percolation ponds were in use (SMC, 1991a). Based on this information, it was estimated that 500 gpm of adit water mixed with 88 gpm of groundwater between the percolation ponds and the downgradient monitoring well. Additional dilution and mixing are qualitatively assumed before the effluent plume leaves the SMC permit boundary.

Indirect impacts to surface water may result after adit water mixes with groundwater in the vicinity of the SVR percolation ponds as this groundwater eventually mixes with surface water. The degree and location at which this mixing occurs is unknown. However, a conservative estimate may be obtained if it is assumed that this mixing occurs immediately downstream of the SMC property. For the purpose of estimating these impacts, it is assumed that 588 gpm of groundwater and adit water will mix with the Stillwater River below the percolation ponds.

4.2.2a Alternative 4a - No Action

Under this alternative the MPDES surface water permit would be renewed based on the existing effluent limitations since no new or enlarged source of pollution would exist. Permit limits in the existing discharge permit are summarized in Table 4.2-1. Based on the adit water quality (Table 3.2-6) SMC would have to provide additional treatment to remove total suspended solids (TSS) from an average of 99 to the permit limit of 20 mg/L. Metal concentrations would also be concurrently reduced since most metals are generally associated with particulate material.

Table 4.2-1 Summary of Effluent Limits in SMC Surface Water Discharge Permit

	Effluent Limitations - Concentration (mg/L)	
Parameter	Daily Average	Daily Maximum
Cadmium	0.0010	0.0015
Copper	0.022	0.033
Lead	0.010	0.015
Mercury	0.00005	0.00008
Zinc	0.02	0.03
Iron	0.20	0.30
Nickel	0.01	0.015
Total Suspended Solids (TSS)	20	30
Oil and Grease	10	N/A

pH shall be maintained between 6.3 and 8.4 standard units.
Phosphorus - There shall be no increase in total phosphorus between SMC-1A and SMC-2.
Nitrogen - Total nitrogen at SMC-2 shall be no greater than 1 mg/L, unless total nitrogen at SMC-1A is greater than 1 mg/L (natural exceedance).

Source: MPDES Permit No. MT-024716

An efficient, cost-effective method for reducing particulate material may be the addition of sand filtration units after clarification. These units could produce an effluent that consistently meets the established criteria. Alternatively, SMC may be able to achieve the specified limits by the use of

settling ponds prior to clarification. However, these technologies would have little or no effect on ammonia and nitrate concentrations.

The surface water loading analysis for alternative 4a is presented in Table 4.2-2 and is based on discharge limits specified in the existing permit (Table 4.2-1). This analysis demonstrates that surface water quality standards would not be exceeded for any parameter and the 1.0 mg/L instream standard for nitrate would not be exceeded.

The current rate (500 gpm) and practice of groundwater disposal would be maintained under this alternative. Table 4.2-3 presents the existing ambient groundwater and effluent quality, and groundwater standards. These levels represent the average ambient concentrations downgradient of the Stillwater Valley Ranch (SVR) percolation ponds. Except for chromium in the effluent, the concentrations of the other dissolved metals are below the ambient amounts. The highest nitrate concentration in monitoring wells below the SVR percolation ponds is 5.4 mg/L.

Table 4.2-2 Projected Surface Water Quality from Direct Discharge for Alternative 4a

Parameter	Existing Water Quality	MPDES Effluent Limits	Projected Water Quality Low Flow	Projected Water Quality Average Flow	Surface Water Quality Standard*
Total Dissolved Solids (TDS)	37	NEL	46	38	250
Total Suspended Solids (TSS)	--	20	--	--	--
Ammonia	<0.1	NEL	0.2	0.1	1.8
Nitrate	0.26	NEL	0.70	0.30	10
Chromium	<0.001	NEL	0.002	0.001	0.055
Copper	0.002	0.022	0.003	0.002	0.003
Iron	0.12	0.02	0.12	0.12	0.3
Lead	0.003	0.01	0.003	0.003	0.0004
Manganese	<0.005	NEL	--	--	0.05
Nickel	<0.005	0.01	0.005	0.005	0.013
Zinc	0.011	0.02	0.011	0.011	0.027

NEL - No effluent level specified in current MPDES permit; projected water quality is based on effluent concentration (total recoverable) without treatment.

* When applicable, standards are based on a hardness of 20 mg/L, pH of 6.5 and temperature of 10°C

Discharge to percolation ponds provides minimal treatment for nutrients but does effectively remove particulate material and hence metals. Ammonia may be lost through volatilization or adsorbed to clay minerals. Nitrate may be converted to nitrogen gas via denitrification under anaerobic conditions and lost to the atmosphere.

Table 4.2-3 Projected Groundwater Quality from Discharge to SVR Percolation Ponds for Alternative 4a

Parameter	Existing Water Quality	Effluent Quality	Groundwater Standard
Total Dissolved Solids (TDS)	167	200	--
Ammonia	<0.1	1.8	--
Nitrate	3.48	8.42	10
Chromium	0.0023	0.004	0.05
Copper	<0.01	0.0006	--
Iron	<0.03	0.03	--
Lead	<0.002	0.0004	0.050
Manganese	<0.02	0.02	--
Nickel	<0.01	<0.005	--
Zinc	0.013	0.01	--

Under the existing MPDES permit, SMC has been granted a mixing zone for groundwater within the property boundary. Under groundwater rules, standards may be exceeded in mixing zones (ARM 16.20.1010). It is likely that nitrate concentrations in groundwater within the property boundary may increase up to the adit water discharge concentration which may exceed 10 mg/L at times. Under the groundwater rules, SMC may be entitled to a mixing zone within the limits of their property boundary (ARM 16.20.1010). Groundwater standards may be exceeded in mixing zones.

Off-site (below SVR ponds) nitrate concentrations in groundwater are qualitatively assumed to increase but would be substantially diluted so that the MCL (10 mg/L) would not be exceeded. The concentration of dissolved chromium in adit water ranges from less than 0.001 to 0.016 mg/L (average 0.004 mg/L). The MCL for chromium is 0.05 mg/L. Therefore, numerical standards would not be exceeded on or off the SMC property.

Impacts to downstream surface water from the current SVR discharge are presented in Table 4.2-4. These impacts are based on dissolved metals since particulate material is effectively removed by percolation. Loading analysis projects increases in ammonia and nitrate concentrations under low and average flow conditions from sustained use of the SVR percolation ponds. Metal concentrations are maintained or reduced due to dilution.

Elevated levels of nitrate, sulfate and TDS reflect the current practice of land application. Land application can be defined as the controlled application of wastes onto the land surface to achieve a specified degree of treatment through physical, chemical, and biological processes within the plant-soil-water matrix. To be effective, wastewater must be applied at a rate which does not saturate soils and result in surface run-off. Land application typically occurs during the six-month growing season, but may be extended up to eight months, depending on yearly weather variations .

There are two general constituents of concern in the wastewater from SMC. The first constituent is the nitrogen species. Most nitrogen in the wastewater is in the form of nitrates; approximately 20 percent of the nitrogen is in the form of ammonia. Ammonia can be lost through

volatilization, taken up by the crop, or adsorbed by the clay minerals in the soil. Nitrate can be taken up by the vegetation, or converted to nitrogen gas via denitrification in anaerobic zones and lost to the atmosphere.

Table 4.2-4 Projected Surface Water Quality Changes from Discharge of Adit Water to SVR Percolation Ponds

Parameter	Existing Water Quality	Effluent Quality	Projected Water Quality Low Flow	Projected Water Quality Average Flow	Surface Water Quality Standard*
Total Dissolved Solids (TDS)	37	200	43	37	250
Ammonia	<0.1	1.8	0.2	0.1	1.8
Nitrate	0.26	8.42	0.54	0.28	10
Chromium	<0.001	0.004	0.001	0.001	0.055
Copper	0.002	0.0006	0.002	0.002	0.003
Iron	0.12	0.03	0.12	0.12	0.3
Lead	0.003	0.0004	0.003	0.003	0.0004
Manganese	<0.005	0.02	0.006	0.005	0.05
Nickel	<0.005	<0.005	0.005	0.005	0.013
Zinc	0.011	0.01	0.011	0.011	0.027

* When applicable, standards are based on a hardness of 20 mg/L, pH of 6.5 and temperature of 10°C

The second constituent of concern is metals. Trace metals removal is a complex process involving the mechanisms of adsorption, precipitation, ion-exchange, and complexation. The major concern is the potential for accumulation in the soil profile, and subsequent transport into vegetation.

EPA has developed guidelines for the land application of municipal sludge to agricultural crop land (EPA, 1983). Land application is a valuable disposal alternative used by many publicly owned municipal treatment facilities. Because of the concern for uptake by plants, EPA has developed recommended application rates for sludge which are often high in metals and other toxic constituents.

For comparative purposes, loading estimates to soil were developed based on the current application rate (500 gpm) to 59 acres for 6 months of the year. These estimates are presented along with EPA recommended application rates for soils with Cation Exchange Capacities (CEC) less than 5 (the lowest category) in Table 4.2-5. Nitrogen requirements vary between 45 to over 312 pounds per acre depending on the plant species. Iron and manganese are trace elements required for plant growth.

As long as soil pH is maintained at 6.0 to 6.5 and loading rates to soils remain below EPA recommended amounts, metal will remain in the soil and not affect groundwater. Any long-term impacts to beneficial uses of these soils would be through plant phytotoxicity. Copper, zinc, and nickel are the elements of most concern to plant phytotoxicity. Again, if soil pH is maintained in this range, these metals should not be taken up by the vegetation in amounts that would cause impairment to plant growth.

Table 4.2-5 Application Rate in Pounds per Acre at SMC and EPA Recommended Cumulative Limits for Agricultural Croplands

Parameter	Current Rate of Application	EPA* Guideline
Nitrogen*	184	--
Cadmium	0.003	4.4
Chromium	0.24	--
Copper	0.54	125
Iron	30.4	--
Lead	0.13	500
Manganese	0.52	--
Nickel	0.37	125
Zinc	0.37	250

* Ammonia and Nitrates
Source: EPA-625/1-83-016 (EPA, 1983)

4.2.2b Alternative 4b - Company's Proposal

Under this alternative adit discharge would increase by average of 289 gpm from 500 to 789 gpm. The increase in blasting would increase nitrogen compounds in discharge water. SMC has proposed to maintain the level of treatment described in Alternative 4a, that is, solids removal through clarification and land application or percolation.

To project the increased concentration of ammonia and nitrates, the average load of ammonia and nitrate was doubled and the resulting concentration was determined based on 789 gpm. The current average load of ammonia and nitrate are 10.8 and 50.5 pounds per day, respectively, based on concentrations of 1.8 and 8.42 mg/l and 500 gpm. The projected concentration is 2.3 and 10.6 mg/L for ammonia and nitrate, respectively. These values will be used to project water quality impacts.

Other factors may effect nitrogen concentrations. The additional 289 gpm would be a result of inflow to the adit of groundwater which is essentially free of nitrogen compounds. This would tend to dilute the nitrate concentration. Based on the existing nitrate and adit discharge data a weak negative correlation exists between nitrate concentration and flow ($r = -0.23$). This data indicates that as additional flows are encountered nitrogen compounds are reduced. However, SMC has indicated that they will eliminate the current practice of pumping freshwater (groundwater) into the adit for drilling purposes. Instead, they will use clarified adit water. Since clarification does not affect nitrate concentrations, this practice may serve to increase nitrate concentration of adit water.

The concentration of metals is expected to remain at the current levels. Metal loads may increase slightly due to the increased volume of water. Projected water quality will be based on current concentrations and projected water volumes.

This alternative evaluates the surface and groundwater concentrations requested in the petition. If granted, these in-stream concentrations would be developed into MPDES effluent limits and incorporated into SMC's discharge permit. Table 4.2-6 identifies the proposed effluent limits

based on the levels presented in the petition. The concentrations of TSS, copper, iron and lead in the effluent exceed the permit limits, therefore, SMC would need to apply additional treatment before direct discharge into the Stillwater River. Conventional treatment options are readily available and discussed under Alternative 4a.

Table 4.2-6 Projected Surface Water Quality from Direct Discharge Under Instream Values Requested in Petition

Parameter	Existing Water Quality	Effluent Quality	Proposed[1] MPDES Effluent Limits	Low Flow	Average Flow	SMC Requested Limits	Surface Water Standard*
Total Dissolved Solids	37	200	200[2]	46	38	200	250
Total Suspended Solids	--	99	20[3]	--	--	--	--
Ammonia	<0.1	2.3	2.3[2]	0.2	0.1	0.4	1.8
Nitrate	0.26	10.6	10.6[2]	0.81	0.31	1	10
Chromium	<0.001	0.015	0.07	0.005	0.001	0.005	0.005
Copper	0.002	0.028	0.02	0.003	0.002	0.003	0.003
Iron	0.12	1.85	1.6	0.20	0.13	0.20	0.03
Lead	0.003	0.007	0.003	0.003	0.003	--	0.0004
Manganese	0.005	0.03	0.46	0.030	0.007	0.03	0.05
Nickel	0.005	0.023	0.1	0.010	0.005	0.01	0.013
Zinc	0.011	0.02	0.08	0.015	0.011	0.015	0.027

1. Based on instream values requested in Petition (SMC, 1991a).
2. Based on average adit water concentration after conventional treatment.
3. Based on BAT (Best Available Treatment Technology) not subject to modification by petition.

* When applicable, standards are based on a hardness of 20 mg/L, pH of 6.5 and temperature of 10°C

The projected concentration in groundwater and surface water below the SVR percolation ponds are presented in Tables 4.2-7 and 4.2-8, respectively.

Table 4.2-7 Projected Groundwater Quality from Discharge to SVR Percolation Ponds

Parameter	Existing Water Quality	Effluent Quality	Projected Water Quality	SMC Requested Limit	Groundwater Standard
Total Dissolved Solids	167	200	178	300	--
Ammonia	<0.1	2.3	0.2	--	--
Nitrate	3.48	10.6	6.3	8	10
Chromium	0.0023	0.004	0.003	0.02	0.05
Copper	<0.01	0.0006	0.0062	--	--
Iron	<0.03	0.03	0.03	--	--
Lead	<0.002	0.0004	0.0014	--	0.05
Manganese	<0.02	0.02	0.02	--	--
Nickel	<0.01	<0.005	0.008	--	--
Zinc	0.013	0.01	0.012	--	--

The land application rate for nitrogen compounds would increase from 184 to 368 pounds per acre. Metal loading to soil would essentially remain the same for cadmium but increase for the other

metals of concern (Table 4.2-9). Based on these analyses, nitrogen application may exceed plant growth requirements and increased leaching of nitrogen through the soil may occur. Metal concentrations in the soil column would remain well below recommended criteria. Concentration of dissolved metal in groundwater would not be expected to increase from land application.

Table 4.2-8 Projected Surface Water Quality from Discharge of Adit Water to SVR Percolation Ponds

Parameter	Existing Water Quality	Effluent Quality	Projected Water Quality Low Flow	Projected Water Quality Average Flow	SMC Requested Limits	Surface Water Standard*
Total Dissolved Solids	37	200	46	38	200	250
Ammonia	<0.1	2.3	0.2	0.1	0.4	1.8
Nitrate	0.26	10.6	0.81	0.31	2	10
Chromium	<0.001	0.004	0.001	0.001	0.005	0.055
Copper	0.002	0.0006	0.002	0.002	0.003	0.003
Iron	0.12	0.03	0.12	0.12	0.2	0.3
Lead	0.003	0.0004	0.003	0.003	--	0.0004
Manganese	<0.005	0.02	0.005	0.005	0.03	0.05
Nickel	<0.005	0.005	0.005	0.005	0.01	0.013
Zinc	0.011	0.01	0.011	0.011	0.015	0.027

* When applicable, standards are based on a hardness of 20 mg/L, pH of 6.5 and temperature of 10°C

Table 4.2-9 Application Rate in Pounds Per Acre Under Alternative 4b and Percent Increase Relative to No Action

Parameter	Pounds per Acre	Percent Increase	EPA Guideline
Nitrogen*	368	100	--
Cadmium	0.003	0	4.4
Chromium	0.44	83	--
Copper	0.85	57	125
Iron	54.4	79	--
Lead	0.20	54	500
Manganese	0.88	69	--
Nickel	0.67	81	125
Zinc	0.58	56	250

* Includes ammonia and nitrate

Impact to Surface and Groundwater From Granting the Petition.

Based on the analyses of Alternative 4b, the concentrations requested by SMC in the petition are achievable in groundwater and surface water after discharge to percolation ponds. Applicable water quality standards would be maintained for class B-1 surface water and Class 1 groundwater. Direct discharge to surface water would require additional treatment before MPDES permit limits are achievable. SMC would be responsible for providing treatment before discharging.

Table 4.2-10 Summary of Water Quality Changes under Alternatives 4a and 4b in the Stillwater River below the Mine Site

Parameter	Existing Water Quality	Low Flow (31.1 CFS)				Average Flow (367 CFS)			
		Direct Discharge Alternative		Percolation Alternative		Direct Discharge Alternative		Percolation Alternative	
		4A	4B	4A	4B	4A	4B	4A	4B
	←----------mg/L----------→								
Total Dissolved Solids (TDS)	37	46	46	43	46	38	38	37	38
Ammonia	<0.1	<0.2	<0.2	<0.2	<0.2	<0.1	<0.1	<0.1	<0.1
Nitrate + Nitrite	0.26	0.7	0.81	0.54	0.81	0.3	0.31	0.28	0.31
Chromium	<0.001	<0.002	<0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Copper	0.002	0.003	0.003	0.002	0.002	0.002	0.002	0.002	0.002
Iron	0.12	0.12	0.2	0.12	0.12	0.12	0.12	0.12	0.12
Lead	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
Manganese	<0.005	<0.005	<0.30	<0.006	<0.005	<0.005	<0.007	<0.005	<0.005
Nickel	<0.005	<0.005	<0.010	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Zinc	0.011	0.11	0.015	0.011	0.011	0.011	0.011	0.011	0.001

The following section contains an analysis of the impacts of granting the petition on beneficial uses in surface and groundwater. Table 4.2-10 summarizes the changes in water quality under Alternative 4A and 4B relative to existing water quality and includes a comparison of the two methods of discharge, that is, direct and percolation. In the following discussion, impacts are discussed relative to ambient concentrations developed under the no-action alternative.

Total Dissolved Solids (TDS). TDS is a measure of the amount of dissolved salts in freshwater. Under low flow conditions concentrations will increase seven percent from 43 to 46 mg/L in surface water. Groundwater concentrations will increase from 167 to 178 mg/L. Increased TDS concentrations are primarily a result of increased calcium, sodium and sulfates in the adit water.

The surface water standard is 250 mg/L and applies to chlorides and sulfates. This standard is based primarily on unfavorable physiological and taste concerns, and increased corrosion for industrial uses. There are no groundwater standards for TDS. Beneficial uses should not be affected by the projected increase in TDS. The concentration requested in the petition is 200 mg/L in surface and groundwater.

Ammonia. Increased ammonia concentrations in surface water would not be measurable under the company's proposal even though nitrogen loads are projected to double. Ambient concentrations in both surface and groundwater are below detectable limits. Since ammonia is lost through volatilization and readily utilized by plants, it is likely ammonia concentration in surface water would only increase through direct discharge.

The freshwater acute and chronic concentrations of ammonia for protection of salmonids species is 20.5 and 1.8 mg/L, respectively, at a pH of 7.0 and 10 degrees (C). Ammonia becomes more toxic at warmer temperatures and higher pH. Direct discharge would result in a maximum concentration of 0.1 mg/L and therefore aquatic species should not be adversely affected due to short- or long-term toxic effects of ammonia. The requested concentration in the petition is 0.4 mg/L for surface water. Any increase in ammonia would contribute to the total inorganic nitrogen concentration which is discussed below.

Nitrate. Nitrate concentrations in the Stillwater River are projected to increase from 0.70 to 0.81 mg/L with direct discharge, and 0.54 to 0.81 mg/L from discharge to percolation ponds under the company's proposal. Groundwater concentrations of nitrate would increase from 3.5 to 6.3 mg/L. Nitrate concentrations are highly variable and would occasionally exceed this amount in the groundwater. Significant dilution with area groundwater and the Stillwater River are expected to dampen these fluctuations so that concentrations off the SMC permit boundary would not exceed the requested concentration or the standard. SMC has requested concentrations of 2 and 8 mg/L in surface and groundwater, respectively.

The drinking water MCL for nitrate is 10 mg/L. Nitrates only become toxic under conditions in which they are, or may be, reduced to nitrite. Nitrite can be fatal to children under the age of 3 months due to the physiological susceptibility of this age group. High nitrates concentrations are

common in domestic water supplies, particularly in rural areas resulting from improperly maintained domestic septic systems or agricultural practices.

Nitrogen loading from the mine, in combination with domestic sewage and agricultural practices may adversely impact existing or future domestic wells on the west side of the Stillwater River below the mine site. It is likely that the degree of mixing is sufficient to prevent exceedance of the drinking water standard (10 mg/L). However, the degree of mixing is unknown at this time.

Because of the lack of uses and additional sources on the east side below the permit boundary, beneficial uses would not be impacted. The degree of mixing is believed to be considerable due to the bedrock constriction of the Stillwater valley below the mine. Any increased nitrogen load in groundwater below this point would likely not be detectable, and therefore, would not adversely affect any beneficial use of groundwater.

Nitrate in surface water may cause an increase in photosynthetic algae. Generally algal growth in freshwater is limited by phosphates. During certain times of the year, excessive growth of algae may lead to secondary problems such as: undesirable aesthetics, tastes and odors; interference with water treatment; increases in biological oxygen demand.

Typically, algal growth in freshwater rivers and streams is thought to be limited by bio-available phosphorous. The optimal ratio of phosphorous to nitrogen for plant growth is 10:1 and was the basis for the 1.0 mg/L in stream limit in the original permit. Recent information indicates that algal growth increases at much lower levels of phosphorus and nitrogen. Algal growth will continue to increase up to a point, beyond which other natural processes will work to reduce the amount of algal biomass in the system (Bahls, 1991). This point is difficult to estimate and will vary from stream to stream depending on other factors, such as: temperature, stream gradient, water level fluctuations and other macro and micronutrient availability. These factors may be operating in the Stillwater River to limit algal growth.

The current MPDES permit specifies that the total nitrogen concentration in the Stillwater River, at the downstream monitoring point, not exceed 1.0 mg/L total nitrogen. SMC has petitioned the BHES to allow 1.0 mg/L inorganic nitrogen. If the BHES grants the SMC petition, the MPDES permit would be re-issued with the new in-stream limit.

The difference between these two forms of nitrogen is that inorganic nitrogen includes a greater percent of bioavailable nitrogen, such as nitrate and ammonia. Bioavailable nitrogen can be assimilated by plants, in this case algae. Total nitrogen includes organically bound nitrogen, such as nitrogen which has been assimilated by algae. Although highly variable, generally half of the total nitrogen in streams is present in the inorganic form.

No numeric criteria have been developed for nitrogen compounds for prevention of undesirable algal growth. The inherent variability of natural systems and multitude of factors which control algal growth preclude the development of such a criteria. Montana water quality standards contain narrative criteria which prohibit the discharge of substances which produce undesirable aquatic life [ARM 16.20.633(1)(e)]. This standard would apply to SMC regardless of the rate of production.

In the absence of a numeric standard, EPA (1986) recommends that inorganic nitrogen not exceed 1.0 mg/L in flowing water for the prevention of undesirable aquatic life. The DHES has adopted this number as a measure of water quality conditions which would lead to an impairment of use (DHES, 1986). It is the judgement of the DHES, based on current knowledge, that the instream concentration of inorganic nitrogen (nitrite + nitrate and ammonia) should not exceed 1.0 mg/L, from all sources, including the SMC discharge. This concentration should prevent the growth of undesirable aquatic life and would not impair beneficial uses of the Stillwater River.

Under Alternative 5, SMC would be required to develop a biological monitoring program that would be used by the agencies to assess algal biomass and community composition and assure compliance with all water quality standards.

Chromium. Chromium may be present in water in either of two oxidation states, chromium(III) or chromium(VI). Chromium(III) is the most common form and is considered an essential nutrient for human health in small quantities. Chromium(VI) is less common and generally occurs in manufacturing or industrial process waste. Industrial categories that generate chromium(VI) wastes include chrome plating, paints and other pigments production (such as toners in laser printers and photocopiers), tanning and electronics.

Limited sampling at SMC indicates that Chromium(III) is the dominate species in adit water. Calculable increases in chromium concentrations may result form the proposed expansion, but it is likely that these increases would not be measurable. The concentration of chromium in adit water is 0.004 and 0.015 mg/L for dissolved and total recoverable, respectively. The highest projected concentration would be in surface water (0.005 mg/L) under direct discharge.

The current drinking water MCL for chromium is 0.05 mg/L, however, EPA has proposed raising the MCL to 0.1 mg/L. The freshwater chronic criteria are 0.011 and 0.055 for chromium (VI) and (III), respectively. SMC has petitioned the BHES for limits of 0.005 and 0.02 mg/L for surface and groundwater, respectively. The projected increases should not adversely affect human health or aquatic organisms.

Copper. Ambient copper concentrations in the Stillwater River would increase from 0.002 to 0.003 mg/L with direct discharge under either alternative 4a or 4b. Discharge to percolation ponds would not affect copper levels and may actually decrease levels in the river due to dilution.

Aquatic organisms are highly sensitive to copper concentrations particularly in waters with low hardness. The freshwater chronic criterion for copper is 0.003 mg/L. There are no known human health impacts associated with copper. EPA has proposed a copper concentration of 1.3 mg/L for public water supplies based on unfavorable taste characteristics. Technology-based discharge criteria (BAT) for copper are 0.15 mg/L average and 0.30 mg/L maximum daily for the platinum mine subcategory (40 CFR Subpart K). Therefore, water-quality based criteria would apply.

The petition requests 0.003 mg/L in surface water. SMC would likely have to provide additional treatment to achieve MPDES discharge limits.

Iron. Iron concentrations in the Stillwater River would increase from 0.12 to 0.20 mg/L with direct discharge under the company's proposal. Surface water concentrations would decrease slightly with continued discharge to percolation ponds. To achieve the proposed discharge limit under any alternative, SMC would have to remove iron from the adit water through additional treatment.

Iron is the fourth most abundant element on earth and is an essential trace element required by both plants and animals. The freshwater criterion for iron is 1.0 mg/L and the recommended level in drinking water supplies is 0.3 mg/L. The petition requests 0.2 mg/L and would not adversely affect human health or aquatic organisms.

Lead. The ambient concentration of lead is 0.003 mg/L in the Stillwater River and less than 0.002 mg/L in groundwater. SMC originally requested a surface water limit for lead in the petition based on data that indicated lead levels in the river were below standards. Subsequent analyses by the WQB and SMC showed the ambient concentration exceeds the standard of 0.0004 mg/L., so no increase could be allowed.

Under the Alternative 4b the proposed MPDES effluent limit for lead would be lowered from 0.010 to 0.003 mg/L. Based on data collected before SMC began operations, and current data, the lead concentration in the Stillwater River has decreased. Impacts from discharge to percolation ponds indicated that lead concentrations in the river would be maintained or slightly reduced. Lead concentrations in adit water are less than in groundwater, therefore groundwater should not be impacted.

The current MCL for lead is 0.05 mg/L, however, EPA has proposed reducing this level to 0.015 mg/L. Technology-based discharge criteria (BAT) for lead are 0.3 mg/L average and 0.6 mg/L maximum daily for the platinum mine subcategory (40 CFR Subpart K). Therefore, water-quality based criteria would apply. SMC has requested a groundwater level of 0.01 mg/L for lead.

Manganese. There is currently no MPDES limit for manganese. Under the company's proposal direct surface water discharge would result in an increase from less than 0.005 to 0.03 mg/L manganese during low flow periods. SMC has requested an instream limit of 0.03 mg/L. There would be no difference in concentration in surface water between Alternative 4a and 4b by discharge to percolation ponds. Manganese concentrations in groundwater may slightly increase but the actual impact would not be measurable since the groundwater concentration is less than detection limits.

Manganese is an essential growth nutrient for plants and animals. Manganese is not known to adversely affect aquatic organisms. The surface water standard of 0.05 mg/L is based on human health and is primarily intended to prevent staining and objectional tastes.

Nickel. Nickel concentrations in ambient water are below the detection limit. The requested ambient concentration of 0.01 mg/L would result in an increase in concentration from under 0.005 to a maximum of 0.01 mg/L if direct surface water discharge were utilized. Surface water concentrations would be maintained through discharge to percolation ponds.

The freshwater chronic criterion for nickel is 0.040 mg/L for aquatic organisms. The human health criterion is 0.013 mg/L and there is no drinking water MCL. The human health criteria is based on long-term exposure to nickel.

The human health criterion is based on evidence that some forms of nickel may be a carcinogen when inhaled. However, limited testing to date has not demonstrated this property for ingestion of nickel compounds (U.S. Public Health Service, 1988). Small amounts of nickel have been demonstrated to be essential for normal growth and reproduction of some animals. The requested limit is below the human health criterion.

Zinc. Adit water concentrations of zinc are slightly elevated relative to ambient concentrations. Direct discharge would increase zinc concentrations from 0.011 to 0.015 mg/L under low flow conditions in the Stillwater River. Surface water concentrations would not be affected under any alternative if discharge to percolation ponds were maintained.

Freshwater chronic criterion for zinc is 0.027 mg/L. This concentration will not be exceeded and therefore no adverse impacts should result from this amount. Technology-based discharge criteria (BAT) for zinc are 0.75 and 1.5 mg/L average and maximum daily, respectively, for the Platinum mine subcategory (40 CFR Subpart K). Therefore, water-quality based criteria would apply.

Summary of Impacts of Granting the Petition (Alternative 2 — 4b)

The preceding section has evaluated the impacts to surface water from direct discharge and after discharge to the SVR percolation ponds. Water quality impacts to groundwater have also been evaluated.

Direct discharge to the Stillwater River under the company's proposal (Alternative 4b) would increase the concentration of nitrate, chromium, iron, manganese, nickel, and zinc under low flow (7-day, 10-year flow) if the petition were granted. Discharge during average flows would result in increased concentrations of nitrate and manganese. Surface water concentrations of other parameters may be affected but would not be detectable. In any case, surface water quality standards would not be exceeded. Human health and aquatic organisms would not be adversely impacted from TDS or metal increases. Aquatic organisms should not be adversely affected if inorganic nitrogen concentrations do not exceed 1.0 mg/L.

The Stillwater River may be indirectly impacted due to discharge of adit water to the SVR percolation ponds and from land application. Land application of clarified adit water may exceed the assimilative capacity of the existing vegetation which would increase nitrates in groundwater and surface water. Metals are effectively removed by land application and would not exceed adverse amounts in the soil column or groundwater under either alternative.

Total dissolved solids and nitrate concentrations in the Stillwater River would increase slightly during low and average flows under the company's proposal as a result of discharge to percolation ponds. Metal concentrations would not be affected.

The average concentration of lead in the Stillwater River exceeds chronic criteria. Lead concentration would not increase under the company's proposal. Since lead is associated with particulate material, LAD application is an effective removal process. Additional treatment to remove particulate material would be necessary before direct surface water discharge. SMC would not be required to treat effluent to reduce lead to below ambient levels (ARM 16.20.618(2)(h)(iv)).

Although lead concentrations exceed chronic standards, bioassay tests conducted by SMC on Stillwater River water indicates that cutthroat trout are not being negatively impacted. Bioassay tests expose subject organisms to actual river water for 96 hours at conditions that simulate river conditions.

Total dissolved solids (TDS), ammonia, nitrate, chromium and nickel concentrations in groundwater are projected to increase within the SMC property boundary under the proposed action. None of these increases would exceed standards. Present and future beneficial uses of groundwater would not be adversely impaired from nitrate increases on the east side of the Stillwater River. With the exception of nitrate, groundwater concentrations outside of the SMC property boundary are not expected to significantly increase above background.

4.2.2c Alternative 4c — Advanced Treatment

SMC has proposed three advanced water treatment options in the petition that would maintain ambient water quality. Adit water, or a portion of it, would be directed to a treatment plant before discharge to either surface or groundwater. The degree of treatment necessary would vary depending on whether SMC chose to continue disposing to a land application system (percolation and irrigation) or to surface water.

Additional analyses were not conducted under this alternative since water quality projections under the No Action Alternative 4a and discussed in Chapter 3 (Affected Environment) would be maintained if the petition were denied. Alternative 4b analyzes the water quality impacts associated with increased production and granting the petition at the levels requested by SMC. Any of these treatment processes would maintain existing water quality.

The degree of water treatment that would be necessary would be based on nitrate removal. Metals would likely be reduced to ambient levels, or below, by pretreatment of the adit water for removal of solids. Pretreatment would be required for each of the proposed treatments. All three treatments could technically achieve the desired degree of treatment for nitrate (MDSL and USFS, 1990).

All of the advanced treatment options would generate a brine by-product that would require disposal. During operations this material may be placed in the tailings impoundment for permanent disposal. However, this material may preclude recycling of adit water and therefore necessitate modification in the current mill circuit that would require discharge of additional effluent to land application or surface water. After closure these wastes may have to be shipped off site for disposal. SMC would be required to submit plans for disposal including waste characterization under the Resource Conservation and Recovery Act (RCRA).

4.2.3 Alternative 3 — Tailing Impoundments

Water quality options would not impact any tailing impoundment configurations.

4.2.4 Alternative 5 — Company Proposal with Modifications

Alternative 5 contains modifications to SMC's monitoring plan which would use lower, more sensitive detection limits for metals in surface and groundwater, and require additional groundwater monitoring locations. Soils would be monitored to assess metal accumulation and removal efficiency. The company's monitoring program would also be modified to include a biological monitoring program for the Stillwater River.

An expanded chemical monitoring program would ensure that off-site ambient water quality is maintained. Allowable ambient concentrations would be determined by the BHES. If off-site ambient concentrations were exceeded, SMC would be required to provide treatment, or modify operations to achieve compliance with ambient concentrations.

The expanded biological monitoring would document changes in periphyton community structure and growth characteristics. However, due to the inherent variation in natural stream community dynamics, changes in periphyton populations alone, would not prompt additional water treatment.

4.2.5 Cumulative Impacts

The impacts of the proposed expansion have been evaluated relative to the existing operation and discussed in the preceding sections. Incremental increases in the concentration of nutrients and some metals would result from the proposed expansion unless an advanced treatment option is selected (Alternative 4c). These increases would be less than numerical water quality standards and would not have adverse impacts, either individually or cumulatively, to human health or aquatic organisms.

Other non-point source activities that may affect the concentration of nitrates, as well as other nutrients, include domestic septic systems, agriculture, logging and mining. Since nitrates are biologically assimilated, numeric water quality standards would not be exceeded as a result of these activities.

Metal concentrations would reasonably be expected to increase as a result of other mining activities within the basin. Any activity that would be considered as a source of groundwater pollution, or a new source of degradation in surface water would be required to maintain existing water quality or petition the BHES for change in water quality. Projected impacts would be evaluated at that time.

The upper 6.6 miles of the Stillwater River above Wounded Man Creek is listed as moderately impaired for metals, sulfate and pH from historic mining activities (WQB, 1990). The Yellowstone River below the Stillwater River is moderately to severely impacted from suspended sediment and

nutrients, primarily resulting from agriculture and municipal sewage. Stream segments are listed as impaired when one or more of the beneficial uses are not fully supported. Discharges from the company's proposal would not impair any beneficial uses or result in further deterioration of these impaired segments.

4.3 Soils and Tailing Impoundment Reclamation/Revegetation

Reclamation issues have been addressed in previous environmental reviews by the agencies in 1985 and 1989 (DSL/FS, 1985; DSL/FS, 1989). Environmental consequences on soils should be minor and short term assuming appropriate construction and reclamation methods are employed. Soil impacts are directly related to the amount of area disturbed. Many acres disturbed by historic activities at the project area are being reclaimed as part of SMC's reclamation plan so that available soil must cover more acres. Limited soil replacement can result in long-term reductions in soil productivity.

Reclamation issues to be investigated in this EIS focus on the limited soil available to reclaim disturbances. The regulatory agencies' interdisciplinary team (IDT) and public scoping identified potential problems with the reclamation plan as proposed in the amendment as well as the plan currently permitted. Therefore, additional analyses were performed to address the potential for long-term reclamation success and soil loss on a revegetated 50 percent slope (the current plan).

4.3.1 Soil Salvage Review

Original soil salvage estimates indicated 0-84 inches of soil was suitable for salvage from the major undisturbed soils in the area (Table 3.3.-1). Some salvage loss was anticipated from the presence of large rocks and boulders on the surface, shallow water tables and depth to bedrock, and by siting facilities on previously disturbed areas.

To date, 38,000 loose cubic yards (Lcy) of soil have been salvaged from all mine disturbances (see page 4-13A and 4-14 of SMC 1990 Amendment Application). Under the currently approved reclamation plan, a total of 39,500 Lcy of topsoil was estimated to be available for the reclamation of 149.3 acres of mine disturbances (See pages 4-43 through 4-48 of SMC 1988 Amendment Application). These estimates were approved and bonded by the agencies. This equals a replacement depth of 1.6 settled inches of topsoil over previously allowed mine disturbances.

Soil salvage to date has largely been limited to the surface horizons only, or in other words, the classic topsoil layer. Soil salvage practices have improved since the original operating permit was issued to SMC in 1986; the value of subsoils for reclamation growth media has been demonstrated. Therefore, a new soil salvage review is needed on the entire mine site to ascertain the extent that subsoils can be used. This soil salvage review has been added as a mitigation in Alternative 5.

Soil Media Testing

To improve reclamation success, the mining company has been testing alternate growth media such as mine waste rock, tunnel boring machine (TBM) waste rock and tailings. Initial evaluations

appear to support the contention that the mine waste products may be blended to produce an acceptable growth media. SMC's use of the TBM has been curtailed, therefore, amount of that waste product available is in doubt. Use of subsoils, especially alluvium and glacial till, would produce better growth media than mine waste rock or tailings. The use of alluvium and glacial till with up to 75 percent coarse fragment content by volume would be better than mine waste rock alone. These subsoils would provide additional rooting depth and limit problems with filter compatibility between a replacement topsoil layer and mine waste rock. A more aggressive testing and evaluation program needs to be implemented to address the blending of waste rock, tailing, and soil as well as any additional fertilizer and organic amendments to enhance reclamation success in the long term at the mine site.

Soil Loss and Productivity

The Universal Soil Loss Equation (USLE) (USDA, 1978) was used to try to predict soil losses on the approved 50 percent (2h:1v) revegetated tailing impoundment embankment slope. The USLE enables users to predict the average rate of soil erosion for alternative land uses and management practices in association with a specific soil type, rainfall pattern, and topography. The USLE was designed for determining impacts on agricultural lands and is not totally applicable to mining scenarios. It does provide a means for comparing predictions based on different assumptions.

The USLE predicts soil erosion amounts by multiplying five environmental factors:

1. Rainfall, including snowmelt and runoff;
2. Soil erodability;
3. Slope length and steepness;
4. Cover from plants, rocks, branches, etc.; and
5. Conservation practices such as varying slope shape or roughness.

The computed soil loss can then be compared to the standard of tolerable soil loss. For soils that are very shallow to shallow, such as at SMC, 1 to 2 tons/acre/year, respectively, is acceptable loss.

The agencies used this equation to evaluate the present reclamation plan. They then modified the slope length and cover factors (changing other factors is either impossible or had negligible effect) to determine if modification of the existing plan could improve the reclamation.

Table 4.3-1 Alternative 3a. Soil Loss Calculations for a 50 percent (2:1) slope with an embankment height of 141 feet. Final reclamation success assuming 50 percent canopy cover, 50 percent rock fragments on the surface, and total ground cover of 60 percent.

IMPORTANT USLE FACTORS		
Slope Length maximum	Sloped Acres	Amount of Soil Loss tons/ac/YR
315'	54	6.5
200'	54	5.1
100'	54	3.5
50'	54	2.4

* Unacceptable soil losses were calculated for all scenarios with less than 50 percent coarse rock fragments in the soil.

Table 4.3-1 lists the predicted soil loss for the current permitted reclamation plan. The permitted slope length for the embankment face is 315 feet. As permitted and when it is reclaimed, the face will cover 54 sloped acres. The predicted soil loss approached tolerable soil losses when soil with 50 percent coarse fragments in the surface horizon, and slope lengths of 50 feet were used in the calculations.

4.3.1.1 Alternative 3a No Action

Under this alternative soil salvage and the proposed replacement of salvaged soil would continue as permitted. Replacement depths would equal 1.6 settled inches over 149.3 acres (Table 3.3.2). These replacement depths over mine waste products would not equal the soil depths in undisturbed soils that existed before mining. If it is assumed that soil salvaged from undisturbed acres has to be spread over all acres disturbed by mining, which includes a lot of previously disturbed acres, then proposed replacement soil depths should equal approximately half of the depth that existed before mining.

The approved plan, according to today's standards, will produce marginal reclamation success, because erosion could limit long-term vegetative production, but would not jeopardize the stability of the tailing impoundment embankment. The embankment would remain as permitted with a height of 141 feet and slope of 50 percent (2h:1v) which is to be revegetated after placement of one foot of soil. Success of the approved embankment reclamation plan would be limited because one foot of replacement soil has not been salvaged and TBM waste may no longer be available for use as a subsoil layer.

4.3.1.2 Alternative 3b Company's Proposal

Under this alternative, soil salvage and the proposed replacement of soil has been increased to 2.0 settled inches over 159.6 acres of disturbance (Table 3.3.2). This increase would still be below the depths needed to cover mine disturbances with approximately half of the original soil depth. Although this would produce marginal success, deeper soil replacement would produce greater success.

SMC has proposed to raise the embankment 14 feet to a total of 155 feet and increase the slope to 62.5 percent (1.6h:1v). In addition, the company proposes to rock armor the slope and not revegetate it, thereby limiting erosion. By increasing the slope to 62.5 percent, the number of sloped acres would decrease to 41.6 acres, a total of 12.4 acres less than the currently approved plan. Total slope length would be 292 feet which is less than the approved plan length of 315 feet.

4.3.1.3 Alternative 3c Partial Approval

Under this alternative, production would be allowed to increase to 2,000 tpd, all facilities expansions and disturbances as proposed by SMC could occur, except modification of the tailing impoundment. However, no additional acres would be disturbed before a soil salvage review could be conducted. Soil replacement depths would remain the same.

Increased biological productivity and lessened impacts to area visuals would be addressed in a modified reclamation plan for the embankment slope as discussed in Alternative 5. The embankment slope would be a mosaic of rock and soil which would address limiting soil loss by reducing slope length.

4.3.1.4 Alternative 3d Modified Impoundment

Under this alternative, soil salvage and replacement depths would remain the same as in alternative 3b, except that soil would be replaced on the embankment face.

In this alternative, the embankment would be increased to 155 feet in height as in the company's proposed action, but the slope would be maintained at 50 percent (2h:1v). This would increase the number of sloped acres to 62 and increase the slope length to 347 feet. Grass revegetation would be implemented as in the current approved plan.

The soil loss predictions in any year after reclamation would be higher than the currently approved plan, as the only change in the soil loss prediction formula is increased slope length.

4.3.1.5 Proposed Action with Modifications — Alternative 5

Mitigations have been developed for all alternatives except No Action, Alternative 1 and 3a.

Soil Mitigation 1 - Soil Salvage review

A soil salvage review is needed because present soil replacement depths are shallow and that produces a marginal probability of reclamation success by limiting vegetative productivity. The review would:

a) try to enhance soil salvage on any additional acres which might be disturbed;
b) inventory subsoils which may become available when mine and mill associated structures are removed at the end of mine life;
c) inventory disturbed soils and other areas where subsoils could be borrowed;
d) be submitted by October 1, 1993 and salvage progress should be updated in annual reports.

This soil salvage review would become the basis for a modified reclamation plan for all mine disturbances.

Soil Mitigation 2 - Alternate Growth Media Review

If soil replacement depths are still marginal after the review, then an aggressive testing and evaluation of mine waste products should be discussed characterizing the long-term desirability of mine waste products as plant growth medium in the rooting zone of revegetated communities such as SMC's present TBM test plots and the toe dike.

Soil Mitigation 3 - Tailing Embankment Slope Length Mitigation

Based upon the soil loss calculation discussed in section 4.3.1, the embankment reclamation plan must be modified to minimize soil loss. The plan should address 1) use of coarse fragments and surface soils 2) reduction of slope length through the use of a mosaic of rock armor and soil. This mosaic plan would maximize biological productivity while minimizing soil loss to erosion and piping into embankment construction materials.

Soil Mitigation 4 - Acid Production Testing

SMC and the agencies have performed static testing of ore and waste materials. So far no indication exists that this mine would produce acid. However, recent research in northern Minnesota indicates that mine ore with less than one-half of one percent content of particular kinds of sulfur can acidify over time (MNDNRC, 1990). To verify continued non-acid-producing status of the Stillwater Mine throughout its life, SMC would develop, with agency approval, a testing program using both static and, if necessary, kinetic testing which would identify the potential for eventual acid production and attendant metals leaching.

4.3.2 Cumulative Effects

Overall soil impacts resulting from this project in conjunction with other CNF projects would be low. No excessive soil erosion is expected to occur which would impact other resources. The cumulative impacts of all local projects would not eliminate any unique soils resources.

4.4 Wildlife

Introduction

During the scoping effort for this project a number of concerns related to wildlife impacts were raised. These are detailed in the Chapter 1 (Sec. 1.7.2) of this document. Through preliminary analysis, the IDT narrowed the focus of wildlife impacts to those species which would most likely be affected by implementation of the company's proposal.

Concerns related to elk impacts were expressed by nearby residents. Apparently fewer elk use the area in and around the Cathedral Mountain Ranch since the mid-1980's. A biologist for the DFW&P has indicated this trend may indeed be taking place. However, the situation may relate more to increased subdivision and subsequent home construction than to operation or expansion of the Stillwater Mine (Stewart 1991, personal communication).

A Biological Assessment is included in this analysis as an appendix. This document assesses the proposed action's potential to negatively impact threatened, endangered or sensitive species within the project area. Correspondence received from the USFWS indicates that in accordance with Section 7(c) of the Endangered Species Act of 1973, the following listed, proposed and category 1 candidate threatened or endangered species may be present in the project area.

Listed Species	Expected Occurrence
bald eagle (Haliaeetus leucocephalus)	winter resident, migrant.
peregrine falcon (Falco peregrinus)	migrant
gray wolf (Canis lupus irremotus)	migrant

Proposed Species
None

Category 1 Candidate Species
None

Cumulative effects for wildlife issues are discussed with each alternative.

4.4.1 Alternative 1 No Action

Direct and Indirect Effects

If the no-action alternative were selected there would be no change in the current trend and condition of wildlife resources within the project area. Neither mule deer nor bighorn sheep would experience additional disturbance to their respective winter ranges that differ from what has been previously analyzed by the agencies (DSL/FS, 1985; DSL/FS, 1989). The Stillwater bighorn sheep herd would be expected to continue its steady population decline. A recently-completed report indicates that the herd is currently at an all-time population low. Within 10 years the population may be eliminated if this trend continues. However, the deer population would continue to thrive. These animals would occupy the winter habitat of the sheep in the event the herd is eliminated. Competition for forage and space is currently high between these two species.

Selection of the no-action alternative would mean no design or construction changes would take place to the tailing impoundment. Current tailing impoundment construction specifications call for the preservation of the current toe dam face. This structure will be used as the foundation for the impoundment dam during the final phase of construction. This will require that construction equipment place mine waste rock on top of the toe dam in successive lifts. During this construction phase, the bighorn sheep are expected to be displaced from the toe dam area upon which they currently depend for forage. Bighorn sheep will not tolerate any disturbance upslope of their position. Once construction is completed in the area of the toe dam, the sheep would most likely begin to use the area again. It is impossible to predict with any certainty how long reoccupation of the site would require.

Additionally, current reclamation specifications call for the complete revegetation of the impoundment at final reclamation. Recent analysis indicates that this reclamation stipulation may be marginally successful. Long slopes constructed at a 2h:1v pitch may erode and be less productive if covered solely by vegetation. If this were to occur, bighorn sheep forage would be lost and the sheep negatively impacted.

Fisheries

The structural integrity of this facility would not be changed, consequently the possibility of dam failure would not change. Therefore, no additional impacts would be introduced related to the trout fisheries which exist in the Stillwater River.

Cumulative Effects

Selection of this alternative would prevent the addition of more persons at the mine. Therefore, increased recreational hunting or fishing demands would not take place due to operation of the Stillwater Mine. No other large-scale employment opportunities are foreseen to occur within the Stillwater drainage. Therefore, additional cumulative impacts are not expected at this time.

4.4.2 Alternative 2 (and 3b) Company's Proposal

Direct and Indirect Effects

Changes which would occur due to selection of this alternative, that have the potential to impact area wildlife resources include: 1) modification to the existing tailing impoundment construction, 2) tailing impoundment reclamation specifications, 3) additional 35 acres of ground disturbance, and 4) increased traffic volumes traveling to and from the mine.

The largest potential negative impact to the bighorn sheep would result from changes to the tailing impoundment construction and reclamation. Currently the sheep rely heavily on the forage on the toe dam. If this alternative is selected, the toe dam would not be immediately eliminated. However, in order to steepen the impoundment dam to a 1.6h:1v slope, lifts of mine waste rock would be placed on top of the toe dam sometime in the near future. When this occurs the sheep are expected to leave the area as long as construction equipment is present. Additionally, the newly-constructed dam face would not be composed of potential sheep forage. Rock armorment is proposed for the impoundment face at final reclamation. This type of impoundment face would be expected to provide security habitat for the sheep, but little forage if any would be provided.

Impacts to the sheep are not expected due to increased traffic at the mine complex. Traffic levels would increase as compared to the current level, however, the impact threshold has already been reached. The sheep would not be able to perceive an increase in traffic volume if the 3.0 passenger/vehicle mitigation measure were applied. Traffic impacts due to vehicle occupancy rates of 2.0 to 2.5 passengers/vehicle would most likely not adversely impact the sheep as long as human-sheep interaction were avoided. This would be accomplished by requiring SMC to continue its internal education program related to sheep-human interactions. Also, the seasonal area restrictions south of the mine would be continued. To date, results of this effort have been successful.

The planned additional 35 acres of ground disturbance would not severely impact the sheep herd. Most of this disturbance is planned to occur outside of the core winter range in areas not heavily used by the sheep. Thus, impacts would be minimal.

Mule deer which inhabit the area seem not to be closely tied to a core range. Thus they display more flexibility in their habitat selection. The area in the vicinity of the tailing impoundment is not heavily used by mule deer. Only the ground disturbance planned for the east side of the Stillwater River has the potential to disrupt mule deer use of the area. This impact is related to construction of the proposed visual berm. Once this structure is constructed, snow would be expected to accumulate on the leeward side during the winter months. This would render forage in that area unavailable. However, a large forage base for this species exists within the project area. Therefore, mule deer are not expected to be impacted by selection of this alternative.

Fisheries

In the event of a catastrophic failure of the tailing impoundment dam, fine particulate material may be incorporated into the Stillwater River. The area downstream of the impoundment serves as an important spawning ground for the trout species which inhabit the Stillwater and Yellowstone drainages. Incorporation of fine sediment into this ecosystem could render these spawning grounds unsuitable for dependent trout species. However, given the low probability of impoundment failure, and the fact that material stored in the impoundment has some degree of shearing strength, the material would not be expected to "flow" into the river.

Cumulative Effects

No additional cumulative effects are foreseen in the project area related to mineral development. SMC represents the only large employment opportunity in the immediate project area. The East Boulder project is not expected to impact wildlife resources in the Stillwater drainage. Wildlife in the Boulder drainage utilizes and occupies available habitats in that drainage. Likewise, the same habitat occupation use patterns take place in the Stillwater drainage.

When the Beartooth District recreational facilities upgrades indicated in the Stillwater IRA are completed, additional opportunities for recreation will be provided. Recreational use by the general public is expected to level off or grow at a reduced pace as compared to past trends. Therefore, recreation demand will not exceed opportunities.

4.4.3 Alternatives 3a No Action, and 3c Tailing Impoundment Partial Approval

Direct and Indirect Effects

If these alternatives were selected no structural change to the tailing impoundment would take place. The discussion of alternative 1 provides the same direct and indirect effects analysis as would be expected due to selection of these alternatives relative to tailing impoundment considerations. Under alternative 3a the approval to increase ore production would be denied. Selection of alternative 3c would increase ore production with no change to the tailing impoundment. Therefore, differences due to selection of these alternatives hinge mainly on increased mine employment and traffic volumes. The environmental consequences of increased employee traffic associated with 3b, 3c, or 3d are displayed in the analysis of alternative 2.

Under alternative 3c, SMC would be required to study and submit a plan related to the long-term tailing impoundment needs. Thus, modification of the current tailing facility is not ruled out if alternative 3c is selected. However, any permit change related to future tailing impoundment modification would require the same level of MEPA/NEPA analysis at the time a proposal would be submitted.

Fisheries

In the event of a catastrophic failure of the tailing impoundment dam, fine particulate material may be incorporated into the Stillwater River. The area downstream of the impoundment serves as an important spawning ground for the trout species which inhabit the Stillwater and Yellowstone drainages. Incorporation of fine sediment into this ecosystem could render these spawning grounds unsuitable for dependent trout species.

Cumulative Effects

Cumulative effects are the same as described under Alternative 2.

4.4.4 Alternative 3d Modified Tailing Impoundment

Direct and Indirect Effects

Selection of this alternative would have the same environmental consequences as displayed under alternative 2 with one major difference. The toe dam which currently is heavily used by the sheep for foraging purposes would be totally eliminated. This would be a result of increased impoundment height while maintaining a 2h:1v slope, thus extending the impoundment slope approximately 55 feet toward the Stillwater River. The toe dam would be buried and, therefore, unavailable for sheep utilization. Consequently, 5 additional acres near the base of the present toe dam would be eliminated from sheep use. If this alternative were selected, and sufficient time not provided to either establish alternative foraging areas or allow the sheep to adjust to this new disturbance, the herd may be eliminated within a few years.

Impacts to both bighorn sheep and mule deer related to increased traffic and additional planned ground disturbances are the same as displayed under alternative 2. Expected impacts resulting from a 100-percent vegetated final reclamation scenario are worse than discussed under alternative 1. Slope lengths would increase due to implementation of alternative 3d. Thus, the possibility of mass erosion would increase. If this alternative were selected without new reclamation specifications, the impoundment slope forage base would be rendered unavailable sometime in the future.

Fisheries

Soil which could be lost from the impoundment face would most likely end up in the Stillwater River. This could pose a threat to the spawning areas downstream of the impoundment.

Cumulative Impacts

Cumulative impacts which would result are the same as those described under alternative 2.

4.4.5 Alternatives 4a, b, and c Water Treatment

Direct and Indirect Effects

Implementation of these alternatives will have no bearing on either the bighorn sheep or mule deer within the project area.

Fisheries

Alternatives 4a, b, and c are evaluated for the purposes of water treatment and compliance with Montana's water non-degradation policy (Sect. 4.2). Minor increases in nutrients, metals and TDS should not adversely impact fish or other aquatic organisms. Secondary impacts of D.O. and pH are not expected to occur.

Cumulative Effects

No adverse cumulative impacts are expected to occur to either the bighorn sheep or mule deer in the project area other than those which have already been disclosed.

4.4.6 Proposed Action with Modifications — Alternative 5

Direct and Indirect Effect

Selection of this alternative would require SMC to enter into a cooperative effort to study vegetation differences which exist between the core winter range and heavily utilized vegetation on the toe dam. This study would explore differences in plant species composition, palatability, and nutrient content. If the results of this study warrant, SMC would cooperate with the regulatory agencies in order to create vegetative conditions on the core winter range which will draw the sheep away for the toe dam area. At a minimum, implementation of SMC's Plan of Operation would require the disturbance of approximately 30 acres of potential sheep and deer habitat. Therefore, a similar area would undergo enhancement. The exact location within the core winter range would be directed by the Coordinated Bighorn Sheep Management Committee which meets at least annually (SMC, August 1991).

Additionally, SMC would continue to implement mitigation prescribed in past analysis documents aimed at preventing the elimination of the sheep herd.

This would result in the minimization of adverse impacts to the bighorn sheep herd. The ultimate goal would be to return the sheep to pre-mining population levels by increasing the overall herd health.

Fisheries

As SMC proceeds toward the stated employment goal of 525 persons, a survey will be conducted to identify any changes in recreational or wildlife use practices resulting from increased employee population levels within Stillwater or Carbon Counties. This effort would help the state and federal agencies identify opportunities for recreation or wildlife uses, or highlight potential problem areas if they exist.

Cumulative Effects

Successful implementation of this alternative may potentially lead to sufficient bighorn sheep herd recovery to warrant the reissuing of bighorn sheep hunting tags within the Stillwater drainage. Increased hunter and guide use within the Stillwater drainage could result. However, this situation is not expected to take place in the foreseeable future.

The East Boulder Project would not have a cumulative effect on the Stillwater bighorn sheep because no Boulder drainage habitats are used by this herd. Sheep within the Boulder drainage are not expected to be displaced by the East Boulder Project into the Stillwater drainage. Therefore, competition for available habitat will not take place.

4.5 Air Quality

4.5.1 Alternative 1--No Action

Under this alternative, air quality conditions would remain similar to the existing situation. Air pollutant emissions from mining operations are, for the most part, proportional to production rates. There would be a very small increase in particulate emissions associated with wind erosion of disturbed or exposed areas, primarily the tailing impoundment, as the acreage increases as per the current plan of operations

4.5.2 Alternative 2--Company's Proposal

The primary pollutant of concern with mining operations is particulate matter. Table 4.5-1 lists the estimated particulate emissions from the project at the proposed production level and the emission controls to be used as shown in SMC's air quality permit application.

The control techniques shown have been determined to represent Best Available Control Technology (BACT) for this project.

As part of the air quality permitting process, SMC has submitted computer simulation modeling of the estimated impacts of the project. The predicted maximum annual PM-10 concentration was 18 $\mu g/m^3$ and the second highest 24-hour concentration was 52.7 $\mu g/m^3$. These are well within the ambient standards of 50 and 150 $\mu g/m^3$ respectively.

SMC prepared a visibility screening analysis to assess the impact to the Absaroka-Beartooth Wilderness Area. The maximum visual impacts inside and outside of the wilderness do not exceed the recommended screening criteria; therefore, there should not be adverse impact on visibility in the area.

Gaseous emissions would result from surface and underground diesel equipment and blasting. The estimated emissions in tons per year are as follows: nitrogen oxides - 118, carbon monoxide - 100, and sulfur dioxide - 11.

No impact to climate would be expected at the emission levels predicted. The Preliminary Determination on this Air Permit Application is included as an appendix.

4.5.3 Alternatives 3c, 3d, and 5

The air quality impacts relative to all the production- increasing alternatives would be very similar to those described in the previous section for the company's proposal. Slight increases in particulate emissions due to wind erosion could result from increases in the amount of disturbed area relative to tailing impoundment alternatives.

Table 4.5-1 Total Particulate Emissions - Worst-Case Annual Period

STILLWATER MINING CO.
TOTAL PARTICULATE EMISSIONS - WORST CASE ANNUAL PERIOD

ACTIVITY	UNCONTROLLED EMISSIONS TON/YR	CONTROL MEASURES	CONTROL EFFICIENCY PERCENT	CONTROLLED EMISSIONS TON/YR
Topsoil Stockpiles	0.03	Revegetation	75	0.01
Disturbed Areas	2.01	Revegetation (42 percent)	30	1.41
Coarse Ore Stockpile	0.01	None	0	0.01
Mine Ventilation Exhaust	25.20	None	0	25.20
Dumping Coarse Ore Into Trucks	3.65	Minimize Fall Distance	0	3.65
Load, Dump Coarse Ore Into	7.30	Minimize Fall	0	7.30
Haul Roads - Ore To Mill Hopper Grizzly	2.83	None	0	2.83
Load, Dump To Coarse Ore Stockpile	7.30	Minimize Fall Distance	0	7.30
Haul Roads - Ore To Coarse Ore Stockpile From West	5.01	None	0	5.01
Haul Roads - Ore To Coarse Ore From East Side	67.16	Chemical Stabilizer/ Watering As Necessary	85	10.07
Dump Waste Rock - 5000-Foot Level (West Side)	2.28	Minimize Fall Distance	0	2.28
Load, Dump Waste Rock On Tailing Embankment	9.12	Minimize Fall Distance	0	9.12
Haul Roads - Waste Rock To Tailing Embankment	25.73	Watering (West Side)	50	6.86
		Chem. Stab. (East)	85	
Vehicle Traffic On Unpaved Roads	36.25	Chemical Stabilizer/ Watering as Necessary	85	5.44
Diesel Exhaust (Surface)	1.84	Operation	0	1.84
Ore Conveyors To SAG Mill	7.30	Enclosed In Building	90	0.73
Concentrate Dryer	1.50	Wet Scrubber	0*	1.50
	204.52			90.56

* Uncontrolled emissions for concentrate dryer are actually controlled emissions.

4.6 Land Uses

4.6.1 Alternative 1--No Action

Land Uses Outside the National Forest

The effects of the no-action alternative on land uses outside the national forest are expected to be minimal. Since the population of Stillwater County is projected to rise even if the mine does not expand (see Section 4.8.1), the demand for recreation on private, state, or BLM-administered lands could increase slightly. Long-term trends in land uses, such as the decline in the amount of land devoted to agriculture, are likely to persist, and certain lands outside the national forest will continue to be the focus of exploration activities of the nature described in Section 2.7.

4.6.2 Alternative 2--Company's Proposal

Land Uses Outside the National Forest

One of the issues which has been raised is that the expansion of the mine will result in a reduction in the value of subdivision property near the mine. A similar issue was identified when SMC submitted a proposal to construct a smelter at the mine site. The issue was addressed in the unpublished preliminary Draft EIS for the smelter (DSL/FS, 1990) by analyzing trends in the value of subdivision lots from before the mine was developed up until 1989 when the DEIS was prepared.

The analysis showed lot prices at the Cathedral Mountain Ranch had appreciated over that period with larger lots showing a greater rate of increase in price than smaller ones. Lot prices in the White Subdivision and the Rainbow Ranch had remained fairly constant, although the time on the market had risen. For the Buffalo Ranch subdivision, the price of lots near the river were stable over the period while more remote lots had depreciated somewhat in value.

Based on this evaluation which showed that development of the mine apparently had no negative impact on lot prices, it was concluded that construction of a smelter at the mine site would not affect land values. Since the proposed expansion of the mine also represents a much smaller change to land uses than the original development of the mine, a similar conclusion appears justified.

Under this alternative, impacts to other land uses outside the national forest are expected to be insignificant. The demand for recreation may increase over and above that anticipated under the no-action alternative, but the additional effects of the mine expansion should be slight. Because of the extremely tight rental market, more land currently used for other purposes (e.g., agriculture) may be developed for housing. The impacts of the proposed expansion on wildlife habitat are discussed in Section 4.4.

4.6.3 Other Alternatives

Land Uses Outside the National Forest

The impacts would essentially be the same as for the company's proposal.

4.6.4 Recreation

Alternative 1, 3a and 4a--No Action

Cumulative effects on recreation issues are discussed under each alternative.

Direct and Indirect Effects

The environmental consequences which would result due to selection of Alternative 1 would represent no change from the existing condition. Currently there are sufficient recreational opportunities which exist to suffice the level of public demand for recreation.

Cumulative Effects

No adverse cumulative effect to recreationist or the recreation resource would be triggered by selection of Alternative 1 since no additional demand for the limited opportunities would occur.

4.6.4.2 All Remaining Alternatives (2, 3b, 3c, 3d, 4b, 4c, and 5)

Direct and Indirect Effects

The environmental consequences related to all remaining alternatives would be the same. In order to implement any of these alternatives, employment at the mine would be increased to 525. SMC projects that one half of new hires would come from outside the local area. Many of these new employees will bring families to the area as indicated in the socioeconomics analysis.

The direct and indirect effects resulting from selection of one of these alternatives consist of increased human competition for the available recreational opportunities within the Stillwater drainage. As a result of this increased competition, accelerated recreation resource damage may occur to existing facilities. This would be expected to continue until planned capacity upgrades or additional recreational opportunities listed in the Stillwater IRA projects of concern are constructed.

Cumulative Effects

Surveys conducted as the result of mitigation measure 8, prescribed by the 1985 Record of Decision and associated EIS, indicated that SMC employees recreated mainly within the Stillwater drainage. This trend is expected to continue. Therefore, no adverse cumulative effects are projected to occur outside of Stillwater County.

Additionally, other minerals development activities such as Chrome Corporation of America, or Platinum International are not reasonably foreseeable at this time in terms of full scale mine development. Once the East Boulder Project comes on line, persons employed at that facility are not expected to travel in large numbers to the Stillwater drainage for recreational purposes. Therefore, no adverse cumulative impacts are anticipated at this time.

4.7 Aesthetics

The CNF's visual resources are managed under the USDA's National Forest Landscape Management System described in USFS Handbooks 434 and 462. This system employs an inventory of the qualitative attributes of each forest acre to produce a VQO that will correspond appropriately to management area prescriptions developed in the Custer National Forest Management Plan (USFS, 1986)

4.7.1 Alternative 1--No Action

Consequences of selecting the no-action alternative mainly involve the long term goal of Retention for visual quality. All existing disturbances would remain the same along with their attendant reclamation requirements. By not increasing production, the life of the mine would remain the same and the time span for these unreclaimed visual and auditory disturbances could not be reduced.

The most significant visual alteration, the tailing dam, would remain at its current height in this alternative, and would be revegetated entirely with grass. This treatment would blend somewhat with the characteristic valley floor but would emphasize the strong horizontal line made by the top of the dam.

4.7.2 Alternative 2--Company's Proposal

Consequences of selecting this alternative result from the proposal to double daily production rates, necessarily raising the current dam height 14 feet. For final reclamation, rock armor for erosion control on the tailing dam, at 1.6h:1v is also proposed.

Impacts relating to the height of the dam in all alternatives vary only in degree in the short term but have greater effects in terms of meeting objectives at the cessation of mining operations. In this alternative, visual impacts are greatest due to the proposed increase in observable surface area of the dam and in the uniformity of the erosion control method. Variety in the landscape is the most significant aspect of scenic quality. Regardless of dam height, the two alterations that will have the most effect on whether the VQO of Retention will be attained are the horizontal top line of the dam and the final treatment for the slope. These two, particularly the top of the dam, can be perceived by travelers along the valley highway from middle ground and background distances up to five or six miles. In the foreground, the impact is more a problem of texture. The uniform slope is out of place in this environment of natural variety.

4.7.3 Alternative 3--Tailing Impoundment Alternatives

3a. Same as no action -- see No Action Alternative above

3b. Same as SMC Proposal -- see SMC Alternative above

3c. Visual impacts would be the same as the no-action alternative unless reevaluation raised dam height.

3d. Visual impacts would be greater than but of the same type as the no-action alternative because the grass revegetation would dominate the view of the tailing impoundment. It would also emphasize the increased height.

4.7.4 Alternative 4--Water Treatment

These alternatives have no effect on visual quality.

4.7.5 Alternative 5--Proposed Action with Modification

Implementation of this alternative would reduce the amount of visual disturbances during mining operations, increase variety in form and texture, as well as considerably shortening reclamation time necessary to achieve the Retention visual quality. This alternative would make reductions in existing adverse visual impacts as well as those resulting from proposed actions. Through the incorporation of the mitigation measures that are part of this alternative, natural visual variety would be increased on the embankment, the line formed by the top of the dam would be broken, and screening would be provided in administrative areas that could help conceal buildings and cars in the daytime and veil operational lighting from the rest of the valley at night.

4.8 Socioeconomics/Traffic

4.8.1 No Action

4.8.1.1 Socioeconomics

Under the no-action alternative, expansion of the mine would not occur and production levels would remain at about 1,000 tpd. The employment and income generated by the expansion would be foregone, and the additional demands on housing and community services would be avoided. The local economy would continue to grow, but at a slower rate. Following are population and employment projections under this alternative.

Population

Projections by NPA Data Services (1991) indicate that the population of Stillwater County is expected to increase to 7,010 in 1995 and 7,350 in the year 2000. (The population effects of the mine expansion are not taken into account in the projections.) From a July 1, 1990 estimated population of 6,550, these projections represent a growth rate of 1.4 percent per year over the 1990-1995 period and 0.9 percent annually from 1995 to the year 2000. The Stillwater County population is, therefore, forecast to expand at a slower rate than was experienced in the 1980's. The population of Montana is expected to grow by only 0.7 percent per year between 1990 and 1995 and 0.6 percent from 1995 to 2000.

Employment

Published employment projections consistent with the updated population estimates are not readily available. Therefore, total employment was projected simply by using the 1990 employment-to-population ratio for Stillwater County of 49 percent. Applying this percentage to the population forecasts discussed above yields employment projections for 1995 and 2000 of 3,456 and 3,623, respectively.

4.8.2 Alternative 2--Company's Proposal

4.8.2.1 Socioeconomics

The effects of the company's proposal on population, employment, and income were assessed using IMPLAN, a computerized input-output model. Detailed information on IMPLAN is available upon request. It should be noted that the economic and social impacts discussed below are applicable to a production level of 2,000 tpd. Since the expansion is likely to take place incrementally, the impacts will not be realized at once, but, instead, will be spread out over several years. Also, no attempt has been made to estimate the economic or social impacts caused by construction-related activity.

Employment

The effects of the proposed expansion on employment in Stillwater County can be categorized into direct, indirect, and induced impacts. Direct impacts are the effects on the initial sector experiencing a change in final demand, which, in this case, is the mining industry. Indirect economic impacts refer to the impacts on industries which provide inputs to the mining sector (e.g., electric power), and induced impacts are those which result from employees and business owners spending their income within the area. Depending upon the type of impact and, hence, the industries that are affected, employment generated by the project can be a mixture of seasonal, year-round, full-time, and part-time positions.

According to the plan of operations, employment at the mine would rise to 525 once the targeted production rate of 2,000 tpd is reached. Employment would then be 161 above the post-layoff March 31, 1991 figure of 364, but only 42 higher than the December 31, 1990 total of 483 employees. The plan of operations uses 460, the maximum employment projected in the 1988 amendment to the Hard Rock Mining Impact Plan, as the base employment figure from which changes are measured. By contrast, this analysis will use the most current employment level, 364, as the benchmark. The direct employment impact of the project is, therefore, 161 jobs. These would be full-time, year-round positions.

It is estimated that approximately 39 jobs will be created in several different sectors (e.g., motor freight, wholesale trade, maintenance and repair facilities) due to the indirect effects of the proposed expansion. This figure was derived by making adjustments to the output from the IMPLAN model to better reflect local economic conditions. For example, according to the model results, the estimated indirect employment impact of the expansion may have been quite large for a particular

sector. If this sector already provided goods or services to the mine, this presumably would have been reflected in actual employment trends in Stillwater County over the past several years.

For many such sectors, employment has been relatively stable or has even declined since before the mine began producing. Thus, the initial estimates generated by the IMPLAN model of the indirect impacts of the proposed mine expansion were clearly too high, either because the production function used in the model was not specific to this operation and some inputs are not actually used by the mine or because the mine does need these inputs, but they are supplied from outside the county. Adjustments to the model to reduce the indirect employment impacts for several sectors were, therefore, made, but the indirect effects may still be somewhat overstated for the reasons discussed above. It should also be noted that employment impact for many industries amounted to less than a full-time position, so the result may be an increase in the hours worked by current employees, rather than the hiring of additional persons.

The induced impacts of the project caused by spending by employees and business owners is anticipated to generate another 32 jobs in Stillwater County, with most of these occurring in the retail trade and services sectors. Adjustments similar to those made for the indirect employment estimates were also required for the projections of the induced impacts. Aggregating the direct, indirect, and induced impacts of the proposal then results in a total employment impact of 232 jobs (Figure 4.8-1).

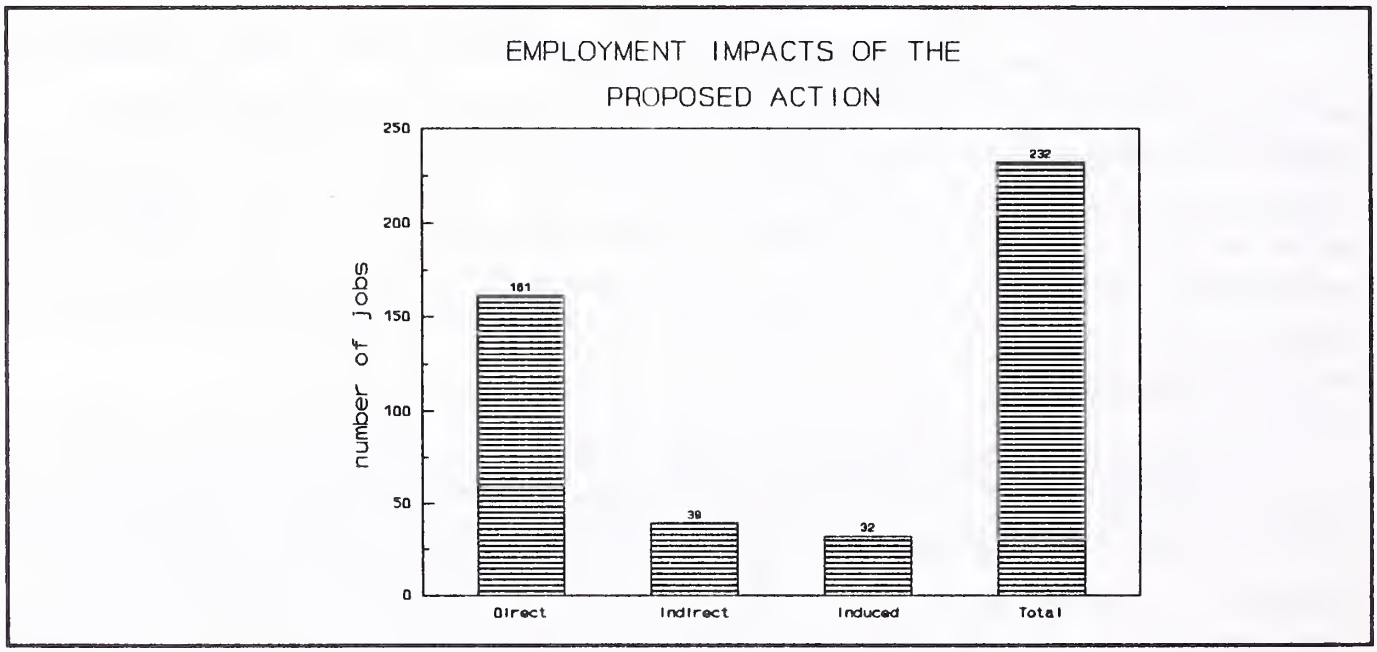

Figure 4.8-1 Employment Impacts of the Proposed Action

Income

Expressed in constant 1990 dollars, approximately $9.1 million in income would be generated in Stillwater County from the expansion of the mine. The direct impact on the mining sector accounts for about 71 percent of the total, or $6.5 million, with the indirect and induced impacts making up the remainder. This income estimate includes not only employee compensation, but also property income such as profits, rents, royalties, and interest. Property income is reported by place of production

rather than by place of residence of the owners, so the income impact on Stillwater County may be overstated to the extent that the property owners live elsewhere.

Population

According to the plan of operations, the company anticipates that, of the 65 employees to be added to their base employment level of 460, about 30 will be hired from the local labor force and the remaining 35 will migrate into Stillwater County from other areas. Although, as discussed above, the number of employees currently working at the mine is less than 460, a review of the Quarterly Impact Monitoring Reports over the period when employment rose to 483 and then declined to 364 indicates that 35 is a reasonable estimate of the number of immigrating workers required to achieve the targeted employment level of 525.

The plan of operations also indicates that the 35 in-migrating workers and their families will increase the Stillwater County population by 107. Under similar assumptions about the local hire percentages, the population change estimates from the IMPLAN model were somewhat less than the company's, because the IMPLAN model used a lower population-to-employment ratio. Since SMC's figures were based upon actual experience at their mine, their estimates are regarded as more reliable.

According to the plan of operations, in-migrating employees in secondary industries and their families are expected to add another 22 persons to the Stillwater County population. This appears to be based, however, on an estimate of the number of secondary jobs that is below that generated by the IMPLAN model. Using the IMPLAN estimates for the indirect and induced employment impacts of the expansion, making the assumption that 20 percent of these jobs will be filled by persons from outside the county, and then applying an average household size of 3.0 persons results in an indirect and induced impact-related population expansion of 43 and, therefore, a total population increase of 150 persons. Adding 150 to the estimates for the no-action alternative yields population projections of 7,160 for 1995 and 7,500 for the year 2000.

Housing

The addition of over 50 new households to Stillwater County will place further pressure on an already tight housing market. Rentals will be even more difficult to find than they already are, as additions to the rental housing stock will continue to lag behind demand. SMC's plan to phase out the mobile home park at the Stratton Ranch will eliminate that source of temporary housing. An adequate supply of building sites is available at the Circle T Ranch and at other locations in the county for those immigrating employees seeking to construct a home, but it normally takes three months or more to build a house. During the construction period, those employees would also be competing for the extremely limited supply of rental housing.

Rents will continue to escalate at a rapid rate, and immigrating employees may have to tolerate a longer commute in order to find suitable housing. As discussed in the Affected Environment section, some current workers already commute from as far away from the mine as Columbus and Red Lodge.

Community Services and Facilities

The effects of the mine expansion on community services and facilities will primarily depend upon the geographic distribution of the in-migrating workers and their families. Any problems associated with the population growth would, of course, be more severe if the in-migrants tended to move to one particular location, but this is viewed as unlikely given the limited availability of housing throughout the area. A more likely scenario would be for the in-migrants to settle in a pattern similar to that of current SMC employees who moved to Stillwater County to work at the mine. This would mean that the largest share of the in-migrating population would live in or near Absarokee with fewer moving to, for example, Columbus or Red Lodge.

The increase in population caused by the expansion of the mine would strain the ability of local jurisdictions to provide some services, but not others. At certain grade levels, the Columbus and Absarokee schools could not accept additional students without exceeding accreditation standards for class size or running out of classrooms. The Fishtail and Nye elementary schools, on the other hand, could accommodate the number of students which would likely move into their respective districts.

As discussed above, the sewer system in Columbus is currently at capacity, so any population growth in Columbus will necessitate an expansion of the system, probably through the addition of aerators. The distribution lines in Columbus' water system also need to be upgraded. Absarokee is experiencing similar difficulties with aging distribution lines in its private water system and one of the storage tanks is leaking, problems which would likely be exacerbated by increases in population. With a private water system, Absarokee is not eligible to use certain sources of funding which might otherwise be available if its water system were public.

Additional traffic caused by greater employment at the mine and population growth will increase the need for road maintenance. According to the Entercom survey, the poor condition of the roads was one of the most often-cited disadvantages to living in Stillwater County. Although the survey was conducted 10 years ago and road upgrades are occurring (e.g., FAS 419), road maintenance still seems to be an important issue with area residents.

The population increase should not adversely affect the capability to provide other services, such as fire protection, law enforcement, emergency services or medical care.

The impacts of the mine expansion on community services and facilities could be mitigated through amendments to the Hard Rock Mining Impact Plan, even if this alternative, the company's proposal, were selected. Whether the Impact Plan is amended depends upon the severity and geographic distribution of the effects, and any mitigation measures that are applied will be similar to those discussed in Section 3.8.6.

Property Tax Base

Expansion of the mine will increase the taxable value of property in Stillwater County, but the size of the increase depends upon a number of assumptions relating to such variables as platinum and palladium prices, machinery and equipment costs, and the value of industrial improvements. In their

petition to the Board of Health and Environmental Sciences, the Stillwater Mining Company has estimated that the expansion will raise their taxable valuation to $8.3 million (SMC, 1991a, p. 4-3). A taxable value of $8.3 million would be over twice as high as the current valuation, but the permit application does indicate that significant capital investments are planned in both the east side and west side facilities and equipment. Also, it is not inconceivable that, for a company to achieve desired reductions in operating costs, capital investment may have to increase at a rate greater than production.

A more conservative estimate of the future taxable value can be derived from the current valuation of the mine. Under the simplified assumption that the value of all mine-related property other than land doubles with production, the taxable value would rise to approximately $6.7 million. Additional property tax revenue generated by the expansion would then range from $949,174 at the lower taxable value to $1,392,729 for a taxable value of $8.3 million. (Minor differences in the revenue estimates may occur, depending upon how the taxable value of the smelter is treated.) The distribution of the additional property tax revenue for the two estimates of taxable value is shown in Table 4.8-1.

Structure of the Local Economy

With expansion of the mine, the economy of Stillwater County will become more dependent upon the mining sector. Once targeted production rates are achieved, mining will likely account for over 30 percent of total labor income. Including the secondary income effects of the mine would result in an even higher figure.

TABLE 4.8-1 DISTRIBUTION OF ADDITIONAL PROPERTY TAX REVENUE FROM MINE EXPANSION

	Taxable Value of $6,728,696	Taxable Value of $8,300,000
State	$154,674	$ 226,954
High School Districts	106,331	156,020
Elementary School Districts	108,659	159,436
Town of Columbus	55,687	81,710
County	499,647	733,135
Absarokee Fire District	17,115	25,113
Rosebud Cemetery	7,061	10,361
Total	$949,174	$1,392,729

The demand for commodities such as platinum and palladium is typically derived from the consumer demand for final goods containing those metals. For example, both platinum and palladium are used in catalytic converters, so the industrial demand for them is determined, to a significant degree, by what is happening in the market for automobiles. Because the local economy is not very diversified, it is, therefore, more vulnerable to fluctuations in the national (and international) markets for the platinum and palladium-embodying final products (e.g., automobiles). Fluctuations in the markets for those products affect not just the mining sector in the local economy, but also the businesses that supply goods and services to the mine and the retail trade and service establishments where employees spend their income.

Although greater demand for final goods containing platinum and palladium can have a positive impact on the economy of Stillwater County, the concern that has been expressed relates more to periods when output levels are reduced or the mine shuts down. The effects on the local economy of production cutbacks or closure of the mine depend upon the duration and magnitude of the actions that are taken. Layoffs of sufficient length and severity could eventually result in out-migration and associated impacts on real estate values, school enrollment, secondary employment, and social services. Residents remaining in the area may be faced with a higher property tax burden or a reduction in the level of services provided by local jurisdictions.

Cumulative Impacts

The nature, scale, and timing of related development activities on the CNF (see Section 2.7) suggest the cumulative impacts on employment, population, income, housing, and community services and facilities will not be appreciably different than the effects of the mine expansion alone. By virtue of their location, projects on the Gallatin National Forest (Section 2.6.2) will, in all likelihood, have negligible socioeconomic impacts on Stillwater County. Some Stillwater County residents could, however, commute to the East Boulder Project.

4.8.3 Other Alternatives

Impacts for all alternatives except for the no-action alternatives (1, 3a and 4a) would be the same as the company's proposal — alternative 2.

4.8.4 Traffic

During the scoping effort for this project, concerns were raised by both SMC employees and the general public related to potential increases in mine related traffic resulting from implementation of the current proposed action. Generally, employees indicated that the 3.0 passengers per vehicle mitigation measure was an infringement upon their civil rights to travel state and county roads. The general public expressed concerns about a number of items including impacts to their quality of life (refer to Chapter 1 for additional concerns raised). The majority of the public voicing these concerns live in the vicinity of Fishtail, MT.

The Montana Department of State Lands and the Forest Service have consulted their respective legal counsels regarding concerns about infringement of personal civil rights. The Forest Service does not

have the regulatory authority to enforce the 3.0 passengers per vehicle traffic mitigation. This is due to the fact that Forest Service authority does not extend beyond National Forest System lands. However, the Montana Department of State Lands has the authority to regulate mine related impacts within the entire State of Montana. Therefore, DSL may legally administer the mitigation measure in question.

4.8.4.1 Alternative 1 — No Action

If the No Action alternative were selected, traffic impacts would be within the scope of analysis conducted for the 1989 East Side EA/PER. The projected level of employment during that analysis was 460. SMC temporarily exceeded the 460 level during February of 1991. The employment reached 483. The 460 employment level and associated traffic impacts are currently covered by the Amended Stillwater Mining Company Hardrock Mining Impact Plan (SMC, 1988).

Latest employment figures supplied by SMC indicate that 365 persons are working at the mine. SMC is presently in compliance with the 3.0 passengers per vehicle mitigation measure which results in approximately 122 mine related vehicles traveling the access corridors to and from the mine on a daily basis. Therefore, the selection of the No Action alternative would not result in additional direct or indirect effects as discussed in the current Hardrock Impact Plan.

Cumulative Effects

Projects which may cumulatively effect traffic volumes on roads leading to and from the Stillwater project area include Custer National Forest improvement projects designed to improve campgrounds, trailheads, and recreational hiking trails. The resulting increased recreational traffic would further add to degradation of lifestyles for those Stillwater County residences along the access routes. Similarly, additional personal safety problems or traffic law violations would be expected to increase to some degree. Additional impacts to the Stillwater Bighorn sheep herd are not expected to take place as a result of increased recreational vehicle traffic, because the area restrictions would be continued from December 1 to April 15 when the sheep occupy the winter range. The impact to Bighorn Sheep due to mine related traffic would remain the same as discussed in the currently approved plan of operations.

4.8.4.2 Alternative 2 - Company's Proposal

SMC has requested relief from the 3.0 passengers per vehicle mitigation measure. If this request were granted, it would result in an increase of mine related vehicles utilizing FAS 419, FAS 420, and FAP 78. Currently, SMC employs approximately 365 persons at the mine. These 365 employees utilized approximately 122 vehicles each day commuting to work, assuming the 3.0 passengers per vehicle rate is met for that day. It is reasonable to expect that the average occupancy rate per vehicle would fall to between 2.0 to 2.5 passengers per vehicle if the mitigation measures were not enforced. This situation would be further complicated when the projected employment level of 525 is achieved sometime in the future. A comparison of these employment levels and the resultant traffic volumes is displayed in Table 4.4-1. The worst case scenario in terms of mine related vehicles using access corridors would be an increase of over 200% (from 122 vehicles per day to 263

vehicles per day) when the full employment level of 525 is realized, and if the vehicle occupancy rate simultaneously falls to 2.0.

Table 4.4-1. Projected Mine Related Vehicle Traffic per day. (The impacts due to this traffic analysis include vehicular travel both to and from the Stillwater project area).

Passengers per Vehicle	3.0	2.5	2.0
Current Employment - 365	122	146	183
Amended HRIA approved - 460	154	184	230
SMC Proposed Employment - 525	175	210	263

Cumulative Effects

Projects which may cumulatively effect traffic volumes on roads leading to and from the Stillwater project area include Custer National Forest improvement projects designed to improve campgrounds, trailheads, and recreational hiking trails. The resulting increase in recreational traffic would further add to degradation of lifestyles for Stillwater County residences along the access routes. Also, personal safety or traffic law violations would be expected to increase proportionately. Additional impacts to the Stillwater Bighorn sheep herd are not expected to take place as a result of increased recreation vehicle traffic. The area restriction will be continued from December 1 to April 15 when the sheep occupy the winter range. Therefore, the potential for increased sheep and human interaction will be eliminated.

4.8.4.3 Environmental Consequences Common to the Remaining Tailings Impoundment and Water Treatment Alternatives

Alternatives 3b, 3c and 3d and 4b and 4c require the same level of employment as the company's proposal in order to implement. These alternatives are concerned with various tailing impoundment and water treatment scenarios. Therefore, the direct, indirect, and cumulative effects of traffic would be the same as indicated in the above section 4.8.4.2.

4.8.4.4 Alternative 5 - Proposed Actions with Modifications

In order to minimize the environmental consequences of the company's proposed action, the following mitigation measures will be implemented.

The request for relief from the 3.0 passengers per vehicle mitigation will not be granted. However, the requirement for monthly data collection and mitigation adherence reporting will be reduced to twice a year. This data will be supplied to the Montana Department of State Lands and the Forest Service for the months of March and September. The average of these two months must meet or exceed the 3.0 passengers per vehicle goal. Additionally, and in response to public input, mine employees living within 10 miles of the mine will not be figured

into the vehicle occupancy goal. Of the 56 employees living within 10 miles of the mine complex, only 24 additional employees would be excluded from the currently permitted carpooling mitigation measures. At 1.0 passenger per vehicle the maximum potential addition is 24 vehicles per day spread out over three shifts. Because of past practices some voluntary carpooling is anticipated which would reduce this number somewhat. It is unknown how many new employees will move into this 10 mile range, but as discussed in the Socioeconomic Section 4.8.2.1, Community Services and Facilities, the majority of in-migrating employees are expected to move into the Absarokee area approximately 23 miles away.

The expansion of the mill facility will cover some of the present employee parking area. Extension of that parking lot would be allowed on an equal basis to the mill facility expansion, so that no net increase of the parking lot would be realized, and such that the current soil stockpiles just to the north would not be disturbed. The approximate replacement area would be would be 100 by 200 feet. Construction of a parking facility on the east side of the Stillwater River would be approved as outlined in the company's proposal.

Analysis leading to Mitigation

If this alternative were selected, the environmental consequences to mine employees would change as compared to the current conditions. Employees living within 10 miles of the Stillwater project area would no longer be required to car or van pool. Employees living outside of the 10 mile zone would be required to car or van pool while accessing or leaving the mine area. These persons would continue to have their use of state and county roads restricted during the time of access to or departure from the work place. Indirect consequences of the selection of this alternative would include reduced road maintenance cost to Stillwater County, decreased potential for vehicle accidents due to reduced traffic volumes, and possible reduction of wildlife/vehicle collisions (roadkills).

Likewise, the environmental consequences to the general public would remain relatively unchanged from the current conditions. SMC intends to increase employment to 525 persons via this amendment. Prior to recent layoffs at the mine, SMC had employed approximately 480 persons (February, 1991). During this time the 3.0 passengers per vehicle mitigation measure was being met. This resulted in a daily traffic volume of approximately 160 vehicles traveling to and from the mine daily. When SMC achieves full employment, there will be an additional 45 persons employed above the historic high employment figure. The persons who occupy these vehicles will be required to comply with the 3.0 passengers per vehicle mitigation measure. This will result in an increase of 15 vehicles traveling to and from the mine. This represents an increase of 9.4% in SMC mine related traffic as compared to the historic high.

Currently SMC employees 365 persons at the Nye facility. The company is currently in compliance with the traffic reduction mitigation measure which results in approximately 122 vehicles per day traveling to and from the mine site. Once the anticipated employment level of 525 is reached, an additional 161 persons will be hired above the current employment level. This should result in an increase of 53 mine related vehicles traveling to and from the mine daily. This represents an increase of 43.4% over current mine related traffic volumes. This does not represent a substantial increase in

mine related traffic because this increased volume will be distributed over three different access corridors.

The expansion of the 10 mile mitigation exemption zone from the previously permitted 2 mile zone, while possibly increasing traffic by as much as 24 vehicles, is not expected to impact members of the public who expressed traffic related concerns. Most traffic respondents live in the vicinity of Fishtail, MT, which lies approximately 23 miles northeast of the project area. Requiring mine employees who live within the 10 mile zone to comply with the 3.0 passengers per vehicle goal causes unwarranted scheduling and monetary burden on these persons. These people would be required to drive out of their way in order to participate in the car or van pooling effort.

Additional impacts to the Stillwater Valley Bighorn Sheep herd are not expected to take place due to increased traffic. The impact threshold has already been triggered in these sheep. Therefore, the sheep are not expected to perceive the addition of more mine related traffic.

The west side parking facility currently provides adequate space for mine employees to park if the current mitigation measure is met. Thus, additional west side parking, beyond that needed to replace the area lost to mill expansion, is not necessary. No parking currently exist on the east side of the Stillwater River. This area will experience increased support facility development, and some of the administrative staff may be housed in newly constructed facilities. Therefore, adequate parking facilities must be provided for these personnel.

Cumulative Effects

Projects which may cumulatively effect traffic volumes on roads leading to and from the Stillwater Mining Company include Custer National Forest improvement projects designed to improve campgrounds, trailheads, and recreational hiking trails. The resulting increase in recreational traffic would further add to degradation of lifestyles for residences of Stillwater County which live along the access routes. Similarly, additional personal safety or traffic law violations would be expected to increase to some degree. Additional impacts to the Stillwater Bighorn sheep herd are not expected to take place as a result of increased recreation vehicle traffic. The area restriction will be continued from December 1 to April 15 when the sheep occupy the winter range. Therefore, the potential for increased sheep and human interaction will be eliminated.

The East Boulder Project will not have a cumulative effect on the Bighorn Sheep because no Boulder drainage habitats are used by this herd. Sheep within the Boulder drainage are not expected to be displaced into the Stillwater drainage by that development. Therefore, competition for available habitat will not take place.

4.9 Commitment of Resources

4.9.1 Irreversible and Irretrievable Impacts

Increased ore production allowed under Alternatives 2, 3b, 3c, 3d, and 5 would be a permanent irreversible commitment of almost 4 million more tons of ore.

Tailing impoundment 3b would result in 47 acres of irreversibly lost wildlife habitat.

Increased power demands of advanced water treatments (Alternative 4c) would result in irreversible loss of power resources.

Increased employment might result in unquantified irreversible impacts associated with housing development activity in Stillwater County.

Erosion of soils during periods of non-vegetation would result in an irreversible loss. Productivity would be decreased temporarily.

4.9.2 Other Impacts That Cannot be Totally Mitigated

Some visual impacts would occur if either Tailing Impoundment 3b or 3d is chosen due to the increased height.

Stockpiled soils lose some productivity because of the destruction of their structures and microbiological activity.

The 30-acre increase in disturbance area would withdraw this amount of habitat for the life of this proposal. On-going reclamation and habitat improvement programs help reduce this impact.

Depending upon the options selected (Water Alternative 4b, or 4c), a small, to a varying degree, irretrievable loss of water quality would occur which would extend throughout mine operation and for a few years after closure. The amount would be limited by the BHES decision. Beneficial uses of surface and groundwater in the vicinity of the mine would not be adversely impaired.

Increased production would result in air quality losses until reclamation. The amount would be limited to levels set in the Air Quality Permit.

CHAPTER 5 - COMPARISON OF ALTERNATIVES

5.0 Summary and Comparison of Alternatives

The purpose of this chapter is to summarize and compare the alternatives in relation to their major impacts. Table 5.0-1 shows graphically how impacts to a resource might change between alternatives, or reading downward, what the major impacts for that alternative would be. The reader is encouraged to refer back to appropriate sections of the document for complete analysis.

This chapter is organized by alternative so that the major impacts resulting from selecting that alternative are listed in one place. The no-action alternative 1 is usually considered the standard against which all other alternatives are compared. It is presently permitted and, thus, tells what is happening or what will happen if no action is taken.

5.1 Alternative 1 — No-Action

No-action would continue operations as presently approved, and most impacts would remain near current levels. Production would remain at 1,000 tpd. The tailing impoundment would not be altered. Capacity would allow a 22-year mine life until the year 2013. Reclamation of the embankment slope would be marginal compared to today's understanding of reclamation and more stringent requirements. The question of the impoundment surface gradient would have to be revisited before final reclamation to ensure that sufficient material is placed on the surface to allow for consolidation and settling.

Because no new or enlarged source of pollution would be developed under this alternative, the MPDES surface water permit would be renewed based on existing effluent limitations. To meet these limitations SMC would have to provide additional treatment to remove total suspended solids and that would concurrently reduce metal concentrations before discharging to surface water. Water quality standards would not be exceeded.

SMC uses both land application and infiltration through percolation ponds as the primary method of disposal. These practices are effective treatments for removal of total suspended solids (both methods) and the nitrogen species (land application). Groundwater concentrations of ammonia and nitrate and dissolved chromium would increase slightly but would not exceed standards outside the SMC property boundary.

The present reclamation plan would probably have marginal success, but it could be improved by increasing the amounts of replacement soil. Three factors have led to limited soil salvage: 1) many of SMC's facilities were built purposely on old mining and town disturbances to minimize environmental impacts; 2) amounts of salvageable soil were limited by the presence of large boulders and a high water table; and 3) the value of subsoils with high rock content has been proven. The limited amount of soil has led SMC to test the ability of TBM and other waste materials to grow

Table 5.0-1 Summary of Alternative Impacts

Issue	No-Action - Alternatives 1,3a and 4a	Company's Proposal - Alternatives 2, 3b, 4b	Partial Approval Alternative 3c	Modified Impoundment Alternative 3d	Advanced Treatment Alternative 4c	Company Proposal with Modifications Alternative 5
Tailing Impoundment Construction Section 4.1	Above factors of safety for mass failure; Impoundment size the same; 22 year capacity @ 1000 tpd; No waste rock surplus;	Approaching factors of safety for mass failure; Size increased 4 acres 17 year capacity @ 2000 tpd; 330,000 yd^3 waste rock surplus;	Above factors of safety for mass failure; Size remains the same; 12 year capacity @ 2000 tpd; No waste rock surplus	9 acres larger than present; Above factors of safety for mass failure; Size increased 9 acres; 17 year capacity @ 2000 tpd; 250,000 yd^3 waste rock deficit; must relocate FS 419;	Disposal of additional sludges and/or brines.	No impacts
Water Resources Section 4.2	Nondegradation does not apply MPDES permit renewed based on existing limitations; No surface water quality standard would be exceeded; Groundwater concentrations of ammonia, nitrate and dissolved chromium would increase slightly but would not exceed standards.	Nondegradation applies; Petition to change ambient water quality for total dissolved solids, ammonia, nitrates and metals in both surface and groundwater requires decision by the BHES; Numeric water quality standards would not be exceeded; Human health and aquatic organisms would not be negatively impacted if petition were granted.	Nondegradation applies; Petition to change ambient water quality for total dissolved solids, ammonia, nitrates and metals in both surface and groundwater requires decision by the BHES; Numeric water quality standards would not be exceeded; Human health and aquatic organisms would not be negatively impacted if petition were granted.	Nondegradation applies; Petition to change ambient water quality for total dissolved solids, ammonia, nitrates and metals in both surface and groundwater requires decision by the BHES; Numeric water quality standards would not be exceeded; Human health and aquatic organisms would not be negatively impacted if petition were granted.	Existing water quality conditions would be maintained; May require use of additional chemical reagents; Increased water withdrawals from the Stillwater River.	Nondegradation applies; Petition to change ambient water quality for total dissolved solids, ammonia, nitrates and metals in both surface and groundwater requires decision by the BHES; Numeric water quality standards would not be exceeded; Human health and aquatic organisms would not be negatively impacted if petition were granted.
Soils and Reclamation, including Tailing Impoundment Section 4.3	No increased disturbances; Marginal reclamation because of limited replacement soil; Long tailing embankment slopes increase erosion potential; Irrigating with nitrate increases plant growth;	About 35 acres of new disturbance; Marginal reclamation because of limited replacement soils; Rock armored embankment stops soil erosion but eliminates vegetative productivity on 42 acres; Irrigating with nitrate increases plant growth;	About 20 new acres of disturbance; Marginal reclamation because of limited replacement soils; Long embankment slopes increase soil erosion potential; Irrigating with nitrate increases plant growth;	About 30 new acres of disturbance; Marginal reclamation because of limited replacement soils; Lengthened embankment slope increases erosion potential; Irrigating with nitrate increases plant growth;	No impacts	Changed soil salvage standards increases replacement volumes; Review leads to identification of soil borrow areas to increase soil depths and reclamation potential; Mosaic pattern on embankment reduces erosion substantially;

Issue	No-Action - Alternatives 1,3a and 4a	Company's Proposal - Alternatives 2, 3b, 4b	Partial Approval Alternative 3c	Modified Impoundment Alternative 3d	Advanced Treatment Alternative 4c	Company Proposal with Modifications Alternative 5
Wildlife Section 4.4	Bighorn sheep herd continues to be threatened; Major winter forage on toe dike remains; Future reclaimed embankment might be foraged by bighorns;	Bighorn sheep herd continues to be threatened; Rock armor eliminates forage on toe dike and potential on reclaimed embankment;	Bighorn sheep herd continues to be threatened; Reclaimed embankment might be foraged by bighorns; Toe dike forage remains;	Bighorn sheep herd continues to be threatened; Reclaimed embankment might be foraged by bighorns but toe dike lost; Lengthened embankment might produce less forage than present plan because of erosion;	Added disturbance area decreases habitat desirability;	Mosaic reclamation enhances desirability by increasing diversity and productivity;
Air Quality Section 4.5	No impacts	Some increase in emissions due to increased production	Some increase in emissions due to increased production	Some increase in emissions due to increased production	Some increase in emissions due to increased production	Some increase in emissions due to increased production
Land Use Section 4.6	No impacts	Recreational use would increase some	Recreational use would increase some	Recreational use would increase some	Recreational use would increase some	Recreational use would increase some
Aesthetics Section 4.7	Visually uniform vegetation; Dam height unchanged; Moderate time to achieve retention of visual quality; No visual screening;	Visually uniform rock armor; Dam height raised 14 ft; Longer time after closing to achieve retention of visual quality, but shorter impoundment life; Visual screening berm on east side;	Visually uniform vegetation; Dam height unchanged; Moderate time after closing to achieve retention of visual quality but shortest impoundment life; No waste rock available for east side visual screening berm;	Visually uniform vegetation; Dam height raised 15 feet; Moderate time after closing to achieve retention of visual quality, but shorter impoundment life; No waste rock available for visual screening berm;	Could have visual impact during operations;	Most varied visually; Dam height could be raised 15 ft; Shortest time to achieve retention of visual quality due to mitigation and shorter impoundment life; Probably no waste rock available for visual screening berm;
Socioeconomics/Traffic Section 4.8	Population will grow 800 by year 2000; Housing will remain tight; Some school, sewer and water services will exceed capacity in Columbus and Absarokee; Traffic problems will reduce slightly due to road upgrades;	Total employment impact of 232 jobs; County population increase of 150 over projections; Impacts on housing and community services and facilities more severe; Traffic doubled to about 262 cars per day;	Total employment impact of 232 jobs; County population increase of 150 over projections; Impacts on housing and community services and facilities more severe; Traffic doubled to about 262 cars per day;	Total employment impact of 232 jobs; County population increase of 150 over projections; Impacts on housing and community services and facilities more severe; Traffic doubled to about 262 cars per day;	Total employment impact of 232 jobs; County population increase of 150 over projections; Impacts on housing and community services and facilities more severe; Traffic doubled to about 262 cars per day;	Total employment impact of 232 jobs; County population increase of 150 over projections; Impacts on housing and community services and facilities more severe; Traffic increased by about 25 cars per day;

vegetation. Since original permitting in 1985, reclamation theory has also evolved so soil salvage standards have changed. Now it is known that long slopes with 100 percent vegetation may not be the most desirable and, in fact, could have detrimental effects such as excessive soil erosion. SMC has voluntarily instituted new soil salvage procedures but these have not been formally adopted in the reclamation plan.

Wildlife impacts would remain approximately the same. As reclamation continues, the mine site's winter range, particularly the toe dike, seems to attract more deer and bighorn sheep. The numbers of deer are expected to continue to increase while the viability of the bighorn herd, even with present mitigation, continues to be in doubt.

Air Quality, Land Use, and Aesthetic impacts are expected to remain at present levels.

Socio-economic trends indicate that Stillwater County population will grow at rate of over 1 percent per year until the year 2000 if mine activity were to remain constant. This would be about 800 new persons for a total population of about 7350. Total employment would increase by approximately 400 over the 1990 annual average of 3,229. Housing would remain tight with rentals particularly hard to find. Some school grades in Columbus and Absarokee are presently near accreditation standards and the projected population growth could push them beyond those standards. Also the Columbus sewer system is at capacity and should be expanded before service is expanded. The Absarokee water system needs replacement of aging water lines before increasing service.

Certain road improvements are currently taking place but the condition of area roads continues to be problematical.

5.2 Alternative 2 — Company's Proposal

The company's proposal is driven by its request to increase ore production to 2000 tpd and increase total production by 4 million tons to 13.2 million tons. This would lower unit costs and make the operation more economically viable. To accommodate increased total production, tailing capacity must be increased. The company's proposal would: 1) enlarge the impoundment from 66 to 70 acres total; 2) raise the height 15 feet from 141 to 155 feet; and 3) steepen the outside embankment slope from 2h:1v to 1.6h:1v. SMC also proposes to rock armor the steepened embankment slope. The four major results of this proposal are: 1) the increased capacity of the facility would allow 2000 tpd production to proceed for 17 years until 2008, which is 5 years shorter than alternative 1; 2) factors of safety concerning mass failure of the dam would be lessened; 3) 42 acres of vegetation on the embankment including the toe dike, would be lost; 4) 330,000 cubic yards of excess waste rock would be generated, which SMC proposes to use as a visual berm to screen east side facilities; and 5) about 30 more acres would be disturbed. These changes could be significant.

Under the Water Quality Act, if production were increased to 2000 tpd, the increased discharge of pollutants would be considered a new and enlarged source and would be subject to Montana's nondegradation rules. As a result, SMC petitioned the BHES for an amendment to ambient standards for surface water for nitrate and some metals. SMC proposes to continue using the same methods to treat water, that is, clarification and either land application or percolation. No discharge

of process water is proposed. Surface water quality standards would not be exceeded. Human health and aquatic organisms would not be adversely impacted.

Direct discharge of water to the Stillwater River would increase the concentration of nitrate, chromium, iron, manganese, nickel and zinc if the river were at low flow; under average flow only nitrate and manganese concentrations would increase. As a result of discharge to the SRV percolation ponds, nitrate and total dissolved solids would increase slightly under either low or average flow, but metal concentrations would not be affected.

Inorganic nitrogen concentration in the Stillwater River should not be allowed to exceed 1.0 mg/L to prevent the growth of undesirable aquatic life. The decision to grant or deny SMC's Petition for Modification of Ambient Water Quality (SMC, 1991a and 1992) will be made by the BHES after a public hearing.

Soil salvage and reclamation would remain the same except for the impoundment embankment. Not redistributing soil on the embankment would obviously eliminate soil erosion there. All other aspects of reclamation are the same as alternative 1.

The bighorn sheep would be adversely impacted by the elimination of vegetation on the embankment and toe dike because they presently forage the mine's reclaimed areas heavily in winter. Any loss of winter habitat is expected to have major impacts on the herd's already precarious existence. Habitat improvement efforts have so far been unsuccessful in weaning the sheep from the permit area. Present mitigation would continue, including the yearly review of its effectiveness.

Other wildlife including deer and mountain lions do not seem to be dependent upon the mine's reclamation.

Increased production would have some air quality impacts. However, ambient air quality would still remain well below applicable standards.

Some land use changes could occur due to increased employment and projected population growth. Recreational use would increase to some extent.

The visual impacts of increasing the height of the tailing impoundment and replacing the vegetation on the embankment with rock armor would be that it would be more difficult to camouflage the long linear lines of the impoundment and it would take a longer time to achieve the goal of retention of visual quality.

Socio-economic impacts of the company's proposal would be proportional to those expected under alternative 1. By the year 2000, Stillwater County's population would total 7500, which is 150 more residents than projected under Alternative 1. Most of the increase would center around Absarokee. The housing market would remain tight with probable increases in rents. Some school facilities in Columbus and Absarokee would exceed accreditation standards with projected population growth so that growth attributable to the mine would increase the severity of the problem. Similar problems would also occur concerning sewer service in Columbus and water service in Absarokee

since both of these systems presently need upgrading. No financial predictions were made concerning projected growth of the county, but the mine expansion would contribute about $9 million dollars in wages to the local economy by the year 2000.

Traffic to the mine could double if the car-pooling mitigation is dropped as SMC has requested. Before car-pooling was instituted occupancy hovered slightly above 2 passengers per vehicle. Using this occupancy and projected employment of 525, traffic would increase from 121 to 262 trips per day. Road improvements currently being constructed would reduce some impacts of this increase.

5.3 Alternative 3 — Tailings Impoundment

Alternative 3 contains four options, 3a, 3b, 3c and 3d, concerning tailing impoundments. This alternative was not designed to replace all aspects of the company's proposal, but to focus on the tailing impoundment issue. In theory, any of these options could be inserted into alternatives 2 or 5 to replace the impoundment portion of that alternative. The impacts for the option would replace those of the original impoundment in that alternative.

Two options have already been discussed. Option 3a is the same as no-action alternative 1 and has been discussed in section 5.1 of this chapter. Option 3b is the same as the company's proposal and has been discussed in section 5.2 above.

Option 3c allows the company to increase production to 2000 tpd but would freeze the size of the tailing impoundment. The major impact of this option is that capacity of the impoundment would be reached in 12 years if no further actions were taken. Mining would then have to cease 10 years earlier than planned or another impoundment would have to be built. All waste rock produced would be used for dam construction, backfill and reclamation. No excess material would be available to build the east side visual berm, so 12 fewer acres would be disturbed. Under option 3c, other effects of the existing impoundment would not be changed.

Option 3c increases production to 2000 tpd and, therefore, would most logically be selected with Alternative 2 - the company's proposal or Alternative 5 - proposed action with modifications.

Option 3d allows production of 2000 tpd, but it also increases the capacity of the impoundment so that both of the company's production goals could be reached. Tailing capacity would be increased by raising the height of the dam 14 feet to a total of 155 feet, and by extending the foot of the impoundment an average of 55 feet toward the Stillwater River, thereby enlarging the impoundment 9 acres to total 75 acres. The outside embankment would remain at 2h:1v except along Mountain View Creek. Under option 3d: 1) life of the impoundment would be 17 years until the year 2008; 2) factors of safety concerning mass failure would remain well above standards; 3) the probability of dam failure would exist during the full probable maximum flood (PMF) but that impact would be negligible in relation to the regional flooding which would occur; 4) the embankment slope would be lengthened and enlarged to 62 acres resulting in increased erosion; 5) because the dam would be larger, 250,000 yd^3 would have to be borrowed to build the dam; and 6) FAS 419 would have to be relocated.

This option would have no additional effect on water quality or quantity.

The reclamation plan would remain the same so most impacts would be the same. However, because the embankment slope is lengthened, impacts would be the most severe of any alternative. Erosion would increase and soil productivity would decrease.

Extending the embankment toward the river would eliminate the toe dike. Loss of this habitat would adversely affect the bighorn sheep, but not as severely as alternative 2 (option 3b).

Visual impacts would be the largest for all alternatives because of the increased size of the impoundment. It would take a moderate time period to achieve retention of visual quality.

Because option 3d increases production to 2000 tpd, it would be most compatible with alternatives 2 or 5.

5.4 Alternative 4 - Water Resources

The options in Alternative 4, like alternative 3 cannot stand alone, but must be incorporated with alternative 2 or 5. These options concentrate on water quality. Option 4a is the no-action alternative and has been discussed in alternative 1. The company's proposal is option 4b and has been discussed as alternative 2.

Option 4c Advanced Water Treatments

Advanced water treatments would maintain nitrate levels in surface and groundwater at existing levels. Other constituents, such as, metals and total dissolved solids would be maintained or improved. SMC would not be required to treat to a better quality than existing surface and groundwater quality.

Wastes such as backwash water, sludge and brines generated by the wastewater treatment would require disposal on or off site depending on the operational status of the tailing impoundment.

Additional electrical power may be necessary depending on the treatment option selected. This may require an upgrade of existing power lines. Depending on the treatment option selected, transport and storage of additional chemical reagents, including strong acids or bases, would be required. Additional personnel would be required to operate these facilities.

5.5 Alternative 5 - Proposed Action with Modifications

This alternative uses the company's proposal as a base, but then mitigates many of the identified impacts. Impacts would be as previously discussed except as mitigated below.

The first modification could be to select one of the tailing impoundment options. Alternative 3b is the company's proposal but either 3c or 3d could replace it. Whichever option is selected, field tests for consolidation of the tailing must be conducted near the end of impoundment life so that the

ultimate amount of settlement can be determined. This would assure optimal contouring of the final reclaimed surface.

Reclamation under all alternatives is considered marginal. Even though SMC is taking steps to improve soil salvage and reclamation, the following mitigation would make reclamation even more successful. This mitigation includes: 1) reviewing soils to identify additional salvage areas and volumes and continuing research by SMC on growth potential of waste products; 2) developing a "mosaic" pattern balancing rock armor and vegetative cover to break up the long slopes of the embankment or other areas; and 3) incorporating trees, boulders, etc. in the mosaic to vary the perceived outline and forms of the impoundment and to help screen some facilities. This mitigation would result in greatly enhanced productivity on all areas to be reclaimed.

Implementing the mosaic portions of the reclamation mitigation on option 3b might be very difficult because the steepness of the slope precludes use of heavy equipment for placement of materials. If the mosaic were not implemented wildlife would not reap the benefits of the varied embankment slope, and aesthetically, variety would be lost.

Implementation of the above mitigations on option 3c and 3d would optimize long-term revegetation success using current technology.

Groundwater monitoring, including the addition of new monitoring wells, would assure maintenance of ambient water quality below the SMC permit boundary. If ambient levels were exceeded, SMC would be required by the agencies to implement a remedial action program. Ambient conditions would be either the existing water quality or those determined by the BHES (Alternative 4b). SMC would not be required to treat to better-than-existing conditions.

The other water quality monitoring requirements are intended to ensure the effectiveness of the proposed mitigation measures and validate the agencies' analytical predictions. Expanded water quality, including biological monitoring, would be implemented under this alternative.

Wildlife would be favorably impacted by the generally improved reclamation and mosaic pattern. But, in addition, SMC would be required to enter into a cooperative study to evaluate vegetative differences in composition, nutrition and palatability between the toe dike and core winter range. Depending on the study's results, specific habitat improvements would be implemented to draw the bighorns away from the mine. Off-site enhancement would replace the approximately 30 acres of disturbance from this proposal. Results of this mitigation would be reviewed annually by the Coordinated Bighorn Sheep Management Committee.

To aid the agencies in long-range planning, a survey of recreational preferences of employees would be conducted by SMC as employment levels approach 525.

Adverse aesthetic impacts would be reduced by implementing the modified reclamation plan. Variety is the most important aspect of scenic quality and the mosaic pattern on the embankment aptly fits this statement. The long unnatural lines of the dam would be broken, the embankment would be varied and general reclamation would be enhanced. As a result, this alternative would

minimize the time necessary to achieve the goal of retention of visual quality. Short term or operating impacts would also be reduced by at least partial visual screening of facilities.

Some impacts of the traffic generated by SMC's proposal would be mitigated in alternative 5. Car-pooling with a 3 person per vehicle goal would be retained. However, employees living within 10 miles of the mine would be exempt. Although overall traffic to the mine would increase, the area of greatest concern, Fishtail, would be minimally impacted. Because SMC has reached the car-pooling target for 2 years, compliance reporting would be reduced to only 2 months per year.

Continuing employee education concerning stress to wildlife created by stopping and viewing is expected to eliminate potential adverse impacts to the sheep herd from increased traffic.

5.6 Agencies' Preferred Alternatives

The agencies' preferred alternatives are: Alternative 5 with tailing impoundment 3c and water treatment 4b. Alternative 5 is the company's proposal to increase production to 2,000 tpd and to expand some facilities, but with added mitigation for water monitoring, waste rock monitoring, reclamation, wildlife, traffic and visuals. The tailing impoundment would not be enlarged under Alternative 3c. Alternative 4b means that the degree of water treatment would be determined after a decision is made by the BHES on SMC's Petition for Modification of Ambient Water Quality (SMC, 1991a and 1992).

GLOSSARY

2h:1v	Slope angle measurement; slope is twice as long horizontally as vertically; 3h:1v = 18°; 2.25h:1v = 24°; 2h:1v = 27°; 1.6h:1v = 32°; 1.5h:1v = 34°
AQB	Air Quality Bureau, Department of Health and Environmental Sciences
Clarification	Process of removing suspended particles from water by precipitating them and drawing the sludge off.
Concentration	Amount of material contained in a specified volume, or the strength of a solution (mass per volume).
Degradation	The increase in concentration of certain regulated substances above ambient (background) levels, and may only be allowed by the BHES based on necessary social and economic concerns.
DHES	Montana Department of Health and Environmental Sciences
DNRC	Montana Department of Natural Resources and Conservation
DSL	Montana Department of State Lands
EA	Environmental Assessment - an environmental document of a proposed action and its effects on the environment
EIS	Environmental Impact Statement - a comprehensive environmental document delineating a proposed action's effects on natural and human environment. An EIS gives an in-depth look at specific issues and cumulative effects in an area. Required by the federal National Environmental Policy Act (NEPA) and the Montana Environmental Policy Act (MEPA)
ESA	Federal Endangered Species Act
geotextile	Synthetic material that is used in construction to create desired soil properties and conditions. Geotextiles are used to increase tensile and bearing strength for equipment access, to control water management and flow direction, and are used as filters between materials of varying particle size distribution.
gpd	gallons per day
gpm	gallons per minute

HDPE — High Density Polyethylene - a high density man-made material used for liners. This material deforms with a low probability of puncturing or splitting. Seams are heat welded instead of glued, thus preventing rupture.

LAD — Land application disposal

load — Amount of material carried in a specified length of time (mass per time).

Mg/l — milligrams per liter

permeable — A relative property of material that allows for movement of water. Low permeability of impervious material such as clay would allow less water movement than the high permeability of a pervious medium such as sand and gravel.

pervious — A quantitative description of the hydraulic conductivity of a material. Hydraulic conductivity, also known as permeability, is a relative measurement of the potential groundwater flow rate through the material. Pervious material has a hydraulic conductivity of greater than 100 feet per year (1×10^{-4} cm/second); semi-pervious material is within a hydraulic conductivity range from 1 to 100 feet per year (1×10^{-6} to 1×10^{-4} cm/sec); impervious material has a hydraulic conductivity of less than 1 foot/year (1×10^{-6} cm/sec).

pH — Measure of the acidity or alkalinity; 7 is neutral, low numbers are acidic

ppm — parts per million

SMC — Stillwater Mining Company

TDS — Total dissolved solids

TSP — Total Suspended Particulate

USLE — Universal Soil Loss Equation

WQB — Water Quality Bureau, Department of Health and Environmental Sciences

Water Treatment - Conventional: Means in or of application the processes of coagulation, sedimentation, filtration, and chlorination. If necessary, it may also include taste and odor control and line softening [ARM 16.20.603(4)]. Conventional treatment includes BCT (Best Conventional Pollutant Control Technology) for control of conventional pollutant (BOD, TSS, fecal coliform and pH) and BAT (Best Available Technology) for control of toxic pollutants (40 CFR 125). In addition to the technologies above, conventional treatment includes: secondary settling, pH adjustment, clarification,

complete recycle and reagent substitution. Conventional treatment meets the minimum treatment standards as defined in ARM 16.20.631(3).

Water Treatment - Advanced: Means any water treatment process that removes more contaminants from wastewater than treatments which are in general use. Contaminants removed by advanced treatment include: suspended solids, dissolved organic compounds, and dissolved inorganic materials (including nutrients). Advanced treatment may include: advanced filtration, electrodialysis, ion exchange, reverse osmosis, and biological treatment.

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APPENDIX A - PRELIMINARY DETERMINATION ON AIR QUALITY PERMIT APPLICATION

DEPARTMENT OF
HEALTH AND ENVIRONMENTAL SCIENCES

AIR QUALITY BUREAU

STAN STEPHENS, GOVERNOR

COGSWELL BUILDING

STATE OF MONTANA

FAX # (406) 444-2606

HELENA, MONTANA 59620

(406) 444-3454
FAX # (406) 444-1374

PRELIMINARY DETERMINATION ON PERMIT APPLICATION

Date of Mailing: March 16, 1992

Name of Applicant: Stillwater Mining Company

Source: Stillwater Project - Platinum/Palladium Mine Expansion

Proposed Action: The department proposes to issue a permit, with conditions, to the above-named applicant. The application was assigned permit application number 2459-03.

Proposed Conditions: See attached.

Public Comment: Any member of the public desiring to comment must submit such comments in writing to the bureau at the above address. Comments may address the bureau analysis and determination, and information submitted by the application. In order to be considered, the comments must be received within fifteen (15) days of this notice, which is March 31, 1992. Copies of the application and the bureau's analysis may be inspected at the bureau's office in Helena. For more information you may contact the bureau at 444-3454.

Final Action: The department intends to make a final decision on the application fifteen (15) days after the Final Environmental Assessment is released. A copy of the final decision may be obtained at the above address. The permit shall become final fifteen (15) days after issuance of the final decision, unless the department's decision is appealed to the Board of Health and Environmental Sciences.

Procedures for Appeal: Any person jointly or severally adversely affected by the final action may request a hearing before the Montana Board of Health and Environmental Sciences. Any appeal must be filed within fifteen (15) days after the department renders its final decision. The request for hearing shall contain an affidavit setting forth the grounds for the request.

AN EQUAL OPPORTUNITY EMPLOYER

Any hearing will be held under the provisions of the Montana Administrative Procedures Act. Submit requests for hearing in triplicate to: Chairman, Board of Health and Environmental Sciences, Cogswell Building, Helena, Montana 59620.

For the department,

Jeffrey T. Chaffee, P.E., Chief
Air Quality Bureau

JTC:tjl

Enclosure

cc: Mark Story, USFS
Jim Gelhaus

AIR QUALITY PERMIT

Issued to: Stillwater Mining Company
HC 54, Box 365
Nye, MT 59061

Permit #: 2459-03
Previous Alteration Issued: 3/11/91
Date Preliminary Determination on Alteration Issued: 03/16/92
Final Alteration Issued:

SECTION I: Permitted Facilities

An air quality permit is hereby granted to the above named permittee, hereinafter referred to as recipient, pursuant to Section 75-2-204 and 211, MCA, as amended, and Subchapter 11, PERMIT, CONSTRUCTION AND OPERATION OF AIR CONTAMINANT SOURCES, ARM 16.8.1101 through 16.8.1118 as amended, for the following:

An underground mine, ore processing plant, tailings disposal facility known as the Stillwater Mining Company, Stillwater Project.

SECTION II: Limitations and Conditions

A. Recipient shall control particulate stack emissions by employing a wet scrubber such that stack emissions do not exceed 0.05 grams per dry standard cubic meter. Within 60 days after achieving the maximum production rate, but not later than 180 days after increased production, the recipient shall conduct performance tests to verify compliance with this limitation and submit to the department a detailed description of the process control equipment to be utilized. The department reserves the right to require additional emission testing to determine compliance with the emission limitation.

B. Since a wet scrubber is being utilized, the recipient shall calibrate, maintain, and operate monitoring devices for the continuous measurement of the following:

1. Change in pressure of the gas stream through the scrubber. The monitoring device must be certified by the manufacturer to be accurate within ±250 pascals (±1 inch water) gauge pressure and must be calibrated on an annual basis in accordance with manufacturer's instructions.

2. Scrubbing liquid flow rate to the wet scrubber. The monitoring device must be certified by the manufacturer to be accurate within ±5 percent of design scrubbing liquid flow rate and must be calibrated on at least an annual basis in accordance with manufacturer's instructions.

The recipient shall record the measurements of both the pressure drop across the scrubber and the scrubbing liquid flow rate during the initial performance test of the scrubber and at least weekly thereafter. The recipient shall submit semiannual reports to the department of occurrences when the measurements of the scrubber pressure loss (or gain) and liquid flow rate differ by more than ±30 percent from those measurements recorded during

the most recent performance test. These reports must be submitted within 30 days following the end of the second and fourth calendar quarters and may be combined with the quarterly reports required in the Monitoring Plan (Attachment 1).

C. Process fugitive emissions are subject to an opacity limitation of 10 (ten) percent.

D. The recipient shall furnish the department the following notification:

1. Anticipated date of increased production postmarked not more than 60 days nor less than 30 days prior to such date.

2. Actual date when increased production begins postmarked within 15 days after such date.

E. The recipient shall provide the department at least 30 days prior notice of the date of any performance test in order to allow an observer to be present.

F. Compliance with emission and opacity standards and testing requirements shall be as specified in 40 CFR Part 60, where applicable.

G. The recipient shall operate an ambient air quality monitoring network around the project area. The monitoring requirements are more fully described in the Monitoring Plan (Attachment 1). Exact monitoring locations must be approved by the department prior to installation.

H. If the department determines it to be necessary, the recipient shall install a sprinkler system or provide equivalent mitigative measures to control wind-blown emissions from the tailings facility. The department shall determine the necessity of the control measures above on the basis of personal observation, results of ambient air quality monitoring, complaints or any combination of the above.

I. The recipient shall continue a dust suppression program on any dirt access roads. The necessity for additional measures on other portions of the road or the entire road will be determined by the department through on-site inspections, ambient air quality monitoring, complaints, or any combination of the above.

J. The recipient shall supply the department with specific operational data on an annual basis. This shall include the amount of ore and waste handled, a description of any dust suppression program, fuel consumption and other related information the department may request. With respect to the dust suppression program, the information shall include the areas of application, frequency of application, and amount. This report may be included with the annual report required in the Monitoring Plan (Attachment 1).

K. Mine production and milling rates shall not exceed 730,000 tons per year or 3,500 tons per day.

GENERAL CONDITIONS

A. Inspection - The recipient shall allow the department's representatives access to the source at all reasonable times for the purpose of making inspections, surveys, collecting samples, obtaining data, auditing any monitoring equipment (CEMS, CERMS) or observing any monitoring or testing, and otherwise conducting all necessary functions related to this permit.

B. Waiver - The permit and all the terms, conditions, and matters stated herein shall be deemed accepted if the recipient fails to appeal as indicated below.

C. Compliance with Statutes and Regulations - Specific listing of requirements, limitations, and conditions contained herein does not relieve the applicant from compliance with all applicable statutes and administrative regulations including amendments thereto, nor waive the right of the department to require compliance with all applicable statutes and administrative regulations, including amendments thereto.

D. Enforcement - Violations of limitations, conditions and requirements contained herein may constitute grounds for permit revocation, penalties or other enforcement as specified in Section 75-2-401 et seq., MCA.

E. Appeals - Any person or persons who are jointly or severally adversely affected by the department's decision may request, within fifteen (15) days after the department renders its decision, upon affidavit, setting forth the grounds therefor, a hearing before the Board. A hearing shall be held under the provisions of the Montana Administrative Procedures Act. The department's decision on the application is not final unless fifteen (15) days have elapsed and there is no request for a hearing under this section. The filing of a request for a hearing postpones the effective date of the department's decision until the conclusion of the hearing and issuance of a final decision by the Board.

F. Application Data - Information submitted on behalf of an air quality permit application is hereby incorporated as a condition of that permit including commencement and completion dates of construction.

G. Permit Inspection - As required by ARM 16.8.1115 Inspection of Permit, a copy of the air quality permit shall be made available for inspection by air quality personnel at the location of the permitted source.

H. Construction Commencement - Construction must begin within one year of permit issuance or the permit will be considered withdrawn.

I. Permit Fees - Pursuant to Section 75-2-211, MCA, as amended by the 1991 Legislature, the continuing validity of this permit is conditional upon the payment by the permittee of an annual operation fee, as required by that Section and rules adopted thereunder by the Board of Health and Environmental Sciences.

Attachment 1

AMBIENT AIR MONITORING PLAN
STILLWATER MINING COMPANY
NYE MINE AND MILL

1. This ambient air monitoring plan is required by air quality permit #2459-03 which applies to the Stillwater Mining Company's mine, ore processing plant and tailings disposal facilities near Nye, Montana. This monitoring plan may be changed from time to time by the department, but all current requirements of this plan are also considered conditions of the permit.

2. Stillwater Mining Company shall install, operate, and maintain two ambient air quality and meteorological monitoring stations in the vicinity of their Nye mine and ore processing plant. The exact location of the monitoring sites must be approved by the department and meet all siting requirements contained in the Montana quality assurance manual including revisions, the EPA quality assurance manual including revisions, and Parts 50, 53 and 58 of the Code of Federal Regulation, or any other requirements specified by the department.

3. Stillwater Mining Company shall continue air quality and meteorological monitoring after receiving this permit alteration for at least one year. At that time, the air monitoring data will be reviewed by the department and the department will determine if continued monitoring or additional monitoring is warranted.

4. The department may require continued air monitoring to track long-term impacts of emissions from the facility or require additional ambient air monitoring or analyses if any changes take place in regard to quality and/or quantity of emissions or the area of impact from the emissions.

Location	Site #	Parameter	Frequency
UTM Zone #12 E588600, N5025600, Elev. 5000 ft.	Site #1 Upwind	PM-10[1]	Every third/sixth day[3]
UTM Zone #12 E588700, N5026500 Elev. 5000 ft.	Site #2 Downwind	PM-10[1] Cr, Pb[2]	Every third/sixth day[3] Every third sample*

[1]PM-10 (particulate matter less than 10 microns)
[2]Cr = chromium, Pb = lead
[3]Every third day during May-October; every sixth day during Nov.-April

Data recovery for all parameters shall be at least 80% computed on a quarterly and annual basis. The department may require continued monitoring if this condition is not met.

*Every valid, third PM-10 sample will be analyzed for trace metals. The individual metals concentrations per sample will be reported; composite results will not be allowed.

5. Any ambient air quality or meteorological monitoring network changes proposed by the Stillwater Mining Company must be approved in writing by the department.

6. Stillwater Mining Company shall utilize air quality and meteorological monitoring and quality assurance procedures which are equal to or exceed the requirements described in the Montana Quality Assurance Manual including revisions, the EPA Quality Assurance Manual including revisions, and Parts 50, 53 and 58 of the Code of Federal Regulation, or any other requirements specified by the department.

7. Stillwater Mining Company shall submit quarterly data reports within 45 days after the end of the calendar quarter and an annual data report within 90 days after the end of the calendar year. The annual report may substitute for the fourth quarter report as long as it also includes the requirements of Paragraph 8 below.

8. The quarterly report shall consist of a narrative data summary and a data submittal of all data points on AIRS paper input forms, disks or magnetic tapes which are compatible with the department's computer system. The narrative data summary shall include:

a. A topographic map of appropriate scale with UTM coordinates and a true north arrow showing the air monitoring site locations in relation to the mine and facilities and the general area;

b. A hard copy of the individual data points;

c. The quarterly and monthly means, per site, for PM-10;

d. The first and second highest 24-hour concentrations for PM-10 and metals;

e. A summary of the data collection efficiency;

f. A summary of the reasons for missing data;

g. A precision and accuracy summary (audit);

h. A summary of any ambient standard exceedances; and

i. Calibration information.

9. The annual data report shall consist of a narrative data summary containing:

a. A topographic map of appropriate scale with UTM coordinates and a true north arrow showing the air monitoring site locations in relation to the mine and facilities and the general area;

b. A pollution trend analysis;

c. The annual means, per site, for PM-10 and metals;

d. The first and second highest 24-hour concentrations, per site, for PM-10 and metals;

e. An annual summary of data collection efficiency;

f. An annual summary of precision and accuracy (audit) data;

g. An annual summary of any ambient standard exceedances; and

h. Recommendations for future monitoring.

10. The department may audit, or may require Stillwater Mining Company to contract with an independent firm to audit, the air monitoring network, the laboratory performing associated analyses, and any data handling procedures at unspecified times. On the basis of the audits and subsequent reports, the department may recommend or require changes in the air monitoring network and associated activities in order to improve precision, accuracy and data completeness.

Permit Application Analysis
Stillwater Mining Company
Application #2459-03

I. Introduction

Stillwater Mining Company (SMC) has applied for an alteration to their existing air quality permit for the Stillwater Project. The proposal is for an increase in the mining production rate.

II. Project Description

The current SMC permit allows the mining and processing of 365,000 tons per year (tpy) of ore compared to a proposed rate of 730,00 tpy. The approximate daily rates would go from about 1000 tons per day (tpd) to about 2000 tpd with a maximum of 3500 tpd. There are no proposed changes to the methods of operation.

The original and subsequent alteration applications for the project contain complete descriptions of the project. The last alteration application (Permit #2459A-2) is also attached for information purposes. It includes a list of applicable regulations. Also attached is a letter describing changes to the ambient monitoring plan.

III. Existing Air Quality

SMC operates a particulate sampling program at the mine. Concentrations have been well below applicable standards. The calendar year 1990 PM-10 (particulate matter less than 10 microns) results are summarized below.

Summary of the PM-10 Suspended Particulate Data January, 1990 - December, 1990
Stillwater Mine, Nye, Montana

Site	Ambient 24-Hour Standard	Maximum 24-Hour	Second Highest 24-Hour	Ambient Annual Standard	Arithmetic Annual Average	No. of Samples
1 (Upwind)	150*	34	33	50	10	46
2 (Downwind)	150*	47	41	50	13	49

*Not to be exceeded more than once per year. (Values are in micrograms per cubic meter)

The sampling has also included trace metal analyses of the particulate filters. These levels have also remained low and less than applicable guideline concentrations.

IV. Emission Inventory and Control Technology Review

The following table lists the estimated total particulate emissions for the project. The application also contains a listing of PM-10 emissions estimates.

Stillwater Mining Company
Total Particulate Emissions - Worst Case Annual Period

Activity	Uncontrolled Emissions Ton/Yr	Control Measures	Control Efficiency Percent	Controlled Emissions Ton\Yr
Topsoil Stockpiles	0.03	Revegetation	75	0.01
Disturbed Area	2.01	Revegetation (42 percent)	30	1.41
Coarse Ore Stockpile	0.01	None	0	0.01
Mine Ventilation Exhaust	25.20	None	0	25.20
Dumping Coarse Ore Into Trucks	3.65	Minimize Fall Distance	0	3.65
Load, Dump Coarse Ore Into	7.30	Minimize Fall	0	7.30
Haul Roads - Ore to Mill Hopper Grizzly	2.83	None	0	2.83
Load, Dump to Coarse Ore Stockpile	7.30	Minimize Fall Distance	0	7.30
Haul Roads - Ore to Coarse Ore Stockpile From West	5.01	None	0	5.01
Haul Roads - Ore to Coarse Ore From East Side	67.16	Chemical Stabilizer/ Watering As Necessary	85	10.07
Dump Waste Rock - 5000 Foot Level West Side	2.28	Minimize Fall Distance	0	2.28
Load, Dump Waste Rock On Tailing Embankment	9.12	Minimize Fall Distance	0	9.12
Haul Roads - Waste Rock To Tailing Embankment	25.73	Watering (West Side) Chemical Stab. (East)	50 85	6.86
Vehicle Travel on Unpaved Roads	36.25	Chemical Stabilizer/ Watering as Necessary	85	5.44
Diesel Exhaust (Surface)	1.84	Operation	0	1.84
Ore Conveyors to SAG Mill	7.30	Enclosed In Building	90	0.73
Concentrate Dryer	1.50	Wet Scrubber	0*	1.50
	204.52			90.56

*Uncontrolled emissions for concentrate dryer are actually controlled emissions.

The emission control measures shown have been determined to represent Best Available Control Technology (BACT) for this project. The total emission level of 90.56 tons per year compares with the present permitted level of 50.56 tons per year.

The following table lists the estimated gaseous emissions for the project.

Activity	Sulfur Dioxide tons/yr	Carbon Monoxide tons/yr	Nitrogen Oxides tons/yr
Explosive Detonation	1.7	56.3	14.3
Diesel Equipment Exhaust	8.8	43.4	104.4
TOTAL	10.5	99.7	118.7

V. Impact Analyses

SMC used the Complex 1 model to estimate air quality impacts (PM-10) from the project. On-site meteorological data was used. The results of the modeling analysis are presented below.

Time Period	Maximum Impact	Background	Maximum Concentration	Standard
Annual	5	13	18	50
24-Hour	53	41	94*	150

-Units are micrograms per cubic meter.
*Second highest predicted concentration.

An EPA Level 2 visibility screening analysis was also done to assess the impact on the nearby Class II Absaroka-Beartooth Wilderness area. The maximum visual impacts inside and outside the wilderness area did not exceed the screening criteria recommended in the model, therefore, impacts are assumed to be minimal.

VI MEPA Compliance

The Department of State Lands has prepared a draft Environmental Assessment on the project. The department will issue a final decision within 15 days after issuance of the final Environmental Assessment.

APPENDIX B - BIOLOGICAL ASSESSMENT

BIOLOGICAL ASSESSMENT FOR

THREATENED, ENDANGERED AND SENSITIVE SPECIES

STILLWATER MINE EXPANSION

Clinton McCarthy
Forest Wildlife Biologist

February 1992

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PROJECT DESCRIPTION

This biological assessment evaluates the effects of the proposed expansion of the Stillwater Mine by the Stillwater Mining Company (SMC) on threatened, endangered and sensitive wildlife and plant species potentially found in the area. It tiers to past biological assessments prepared for the Stillwater Mine (Escano 1982, Edwards 1985), and the Final Environmental Impact Statement for the Stillwater Mining Company - Stillwater Project (USDA 1985).

For the purposes of addressing the effects of the proposed SMC expansion, two areas are evaluated. The first is the project area (1,233 acres). Proposals related to the expansion of the Stillwater Mine are contained within this area. The second is the study area (23,547 acres), or general area within the Stillwater River drainage surrounding the project area.

Habitats within the project area (1,233 acres) have been altered by several mining operations over the last 40-50 years. Much of this was associated with chrome production during the second World War. Approximately seven years ago, the Stillwater Mine was developed for platinum and pallidium extraction. Most of the habitats within the project area are disturbed lands or revegetated tailings.

Habitats within the study area (23,547 acres) have been altered by human use such as road building, fire suppression, and some logging. Mining has not dramatically altered most of these habitats.

Where necessary effects are addressed on a larger scale for determining cumulative effects. An overview of the affected environment is defined in the "Final Environmental Impact Statement for the Stillwater Mining Company - Stillwater Project" (USDA 1985).

The following developments are anticipated regarding the SMC expansion within the project area:

Project Wide Expansion Proposals:

- Ore production will increase from 1,000 tons to 2,000 tons per day.
- Employment levels are expected to increase from 364 to 525 persons.

West Side of the Stillwater River:

- The mill and mine building will be expanded 250 feet to the north.
- The main mill complex entrance, security building, mine equipment/truck shop warehouse, and mill maintenance shop will be relocated.
- The West Side percolation ponds may be relocated.
- The present sewage treatment facility, parking lot and mine supply laydown area will be expanded.
- A temporary waste rock storage/laydown area will be created
- The current tailing impoundment will be modified to the following standards:
    - Increasing the height to 5,128 feet from 5,111 feet.

- Increasing the side slope steepness from 2.0 to 1.6.
- Replacing 100 percent of the vegetation reclamation to 100 percent rock armorment.

East Side Stillwater River Modifications:

- The east side office, compressor, supply building will be expanded. This facility would house locomotive equipment, a repair shop, change rooms, mine offices and a ware-house.

- A new sewage treatment facility will be built.

- Two pipelines crossing the Stillwater River will be added to service the water management system.

- A parking lot and mine equipment laydown area will be added.

- A permanent visibility berm would be constructed which would also serve as a waste rock storage.

THREATENED AND ENDANGERED SPECIES

A species list provided by the U.S. Fish and Wildlife Service requested that we address the effects of the expansion on three species federally listed as endangered. These are the :

bald eagle (*Haliaeetus leucocephalus*)
peregrine falcon (*Falco peregrinus*).
gray wolf (*Canis lupus irremotus*)

SENSITIVE SPECIES

The Northern Region of the Forest Service identifies as sensitive those species of vertebrates and plants for which population viability is a concern, as evidenced by: 1) significant current or predicted downward trends in population numbers or densities, or 2) significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution.

The potential effects of the SMC expansion were projected for eight sensitive wildlife and 6 sensitive plant species potentially found within the project or study area. The following species are evaluated.

Animals

harlequin duck (*Histrionicus histrionicus*)
flammulated owl (*Otus flammueolus*)
boreal owl (*Aegolius funereus*)
black-backed woodpecker (*Picoides arcticus*)
Townsend's big-eared bat (*Plecotus townsendii*)
pallid bat (*Antrozous pallidus*)
spotted bat (*Euderma maculatum*)
lynx (*Felis lynx*)

Plants

Gentianopsis simplex
Kobresia macrocarpa
Salix barranttiana
Selaginella watsonii
Shoshonea pulvinata

Thalaspi parviflorum

BALD EAGLE

Existing Conditions

Bald eagles are occasionally observed on the Stillwater River below the mine site during late fall, winter and early spring. Portions of the Stillwater River are considered suitable as winter roost and foraging habitat for bald eagles. There are no documented nesting of bald eagles anywhere in the study area, although local residents have reported bald eagles during the summer months (Escano 1982).

Night roost habitat for wintering bald eagles consists of large diameter conifer stands that are protected from prevailing winds (Keister et al. 1987, Dellasala et al. 1987, and Keister 1983). Generally, these are located on the lee sides of hills or in protected basins. Ponderosa pine is a preferred species due to the open canopies and large branch diameters that mature trees exhibit. These stands are generally adjacent to river systems, wetlands or open areas that provide eagles with foraging opportunities. No night roost areas have been documented on the Stillwater River.

Escano (1982) describes foraging and roost habitat on the Stillwater River and suggests that winter use in probably sporadic and influenced by the presence of open water or carrion availability. Twelve bald eagle sightings were reported within the study area by CDM (1981) in their field studies between August and December 1980. During November and December 1981, eagles were documented on several occasions, with up to three birds seen along the river in one day (Escano 1982). The 1982 mid-winter bald eagle survey identified five bald eagles on the Stillwater River below the study area (Escano 1982). Data collected by CDM (1981) indicates that bald eagles did not spend the entire winter in the study area in 1980-81.

Day roost habitat on the Stillwater River exists within the cottonwood riparian stands along the West Fork and Main Stillwater Rivers. An area of concentrated perching or roosting use exists in the extensive cottonwood woodlands along the Stillwater River on the Keogh Ranch (Escano 1982). Up to seven bald eagles have been observed utilizing this area as a day roost at one time (CDM 1981). Night roosting most likely takes place outside of the riparian woodlands in open, but sheltered, old growth pine stands within flying distance of foraging habitat along the river.

Effects

Edwards (1985) reviewed the potential for effects resulting from the development of the Stillwater Mine on bald eagles in his biological assessment. Habitat loss, human activity including road traffic, power line construction, and noise were evaluated in that document and are disclosed in the Environmental Impact Statement of the Stillwater Mining Company - Stillwater Project (USDA 1985). No additional power lines are proposed, and the 21 acres of disturbance proposed in the expansion will occur on the project area, mostly on lands that have already been disturbed.

Noise and human activity levels will increase within the project area as a result of increased ore production, and infrastructure development at the existing mine. Edwards (1985) and CDM (1981) stated that no nesting or roosting habitat values are associated within or adjacent to the project area. Potential foraging habitat exists within ¼ mile of the mine site, but the levels of use are unknown. The impacts of noise, development and human activity on the project area should not further diminish the value of the Stillwater River as bald eagle foraging habitat beyond current impacts. Edwards (1985) estimated that up to ½ mile of the Stillwater River (3.5 percent of the river length within the study area) could become unsuitable as a result of the initial development.

The effects of additional traffic as a result of the expansion may reduce the suitability of foraging habitat below the mine site. The effects of increased traffic is related to the amount and duration of traffic along

the river, distance from the road to where foraging habitat exists, and the tolerance of eagles to changes in human use patterns. Under a worse case scenario, daily vehicle use could increase from 121 vehicles per day (assumes 365 employees at three people per vehicle to 262 vehicles per day (assumes 525 employees and two people per vehicle). This represents an increase of 216 percent.

The effects of this increase on bald eagle foraging is unclear. The Stillwater River is not considered a major winter foraging or roosting area for bald eagles. The maximum number observed at one time is seven eagles. The increase in vehicle use under the worst case could reduce the availability of forage sites, particularly in close proximity to the road.

Based on the projected increase in human use and the number of bald eagles documented on the Stillwater River, the SMC expansion may affect, but is not likely to adversely effect the bald eagle.

The following mitigation may be appropriate in minimizing the effects of the expansion on bald eagles.

1) Use fences, signs, and speed limits to control traffic speed to reduce the number of road-kill animals that could be potential prey sources for bald eagles. This would reduce the likelihood of vehicle/ bald eagle collisions. No bald eagles have been killed by vehicles on the Stillwater River road to date.

2) Provide bus transportation to the mine site to reduce the number of vehicles travelling and associated disturbances along the Stillwater River.

3) Stipulate that vehicles travelling to the mine have three people per vehicle.

Peregrine Falcon

Existing Conditions

Nesting habitat for peregrine falcons is associated with cliffs that exhibit a considerable amount of sheer cliff face. Foraging habitat is associated with wetland or riverine systems with high densities of passerines, shorebirds and waterfowl.

Peregrine falcons suffered a severe decline in North America from the mid-1940s through the 1970s. The cause for the decline was linked to heavy use of pesticide DDT and subsequent effects on reproduction, habitat loss, and human intrusion into occupied habitats.

Escano (1982) identified five cliff sites as having potential for peregrine nesting along the Stillwater River. One of these is a historical nest site on the West Fork of the Stillwater River. Peregrines occupied this nest site in 1975 and 1976, and unconfirmed sightings of peregrine falcons are reported into the early 1980s. Escano (1982) suggests that 80 percent of the habitats located in the Stillwater River Drainage are suitable for foraging habitat. Currently, there are no known eyeries in the Stillwater River drainage or on the Beartooth Ranger District.

Recovery of the peregrine falcon within the tri-state area of Idaho, Montana and Wyoming (including the Greater Yellowstone Area) began in the 1980s. Eleven young peregrine falcons were released at three different sites near Grand Teton National Park in 1980. By 1984, two pairs of adult peregrine falcons were identified in the Greater Yellowstone area. Reintroduction efforts continued through the 1980s, and by 1991 29 nesting pairs had been located within the tri-state area (Flath 1992).

Peregrine falcons are generally released into the wild by hacking (reintroducing captive reared peregrine falcons into an artificial nest site and cared for by humans until the birds reach independence) or cross-fostering (introducing captive raised peregrine falcons into prairie falcon nest sites). On the Beartooth Ranger District, one hack site was established in the East Fork of Rosebud Creek in 1990.

Three birds were introduced into the wild using this method. The hack site location is approximately 20 miles from the Stillwater Mine.

The 29 nesting pairs found in 1991 represent a nearly complete restoration to the 32 pairs known to nest in the tri-state area prior to the decline. Peregrine recovery targets for the tri-state area are 30 nesting pairs (USDI 1977). Peregrine falcon population growth should continue as long as suitable habitat and a clean environment exist. As the population increases, birds will move to nearby empty habitats and occupy vacant breeding territories.

Nine species which regularly show up as important peregrine prey items were found on the bird transects conducted by CDM (1981): These include: killdeer mourning dove, common flicker, eastern kingbird, Clark's nutcracker, American robin, western meadowlark, Brewer's blackbird, and western tanager. During the summer relatively high densities of western meadowlarks and mourning doves are found in the stony grasslands, and relatively high densities of robins are found in the disturbed grassland mosaic habitats. In the fall high densities of western meadowlarks are found in the stony grassland types.

Effects

Edwards (1985) also identified the potential effects resulting from the development of the Stillwater Mine on peregrine falcons in his biological assessment. The same potential impacts discussed for bald eagles are relevant to peregrine falcons. Habitat loss, human activity including road traffic, and noise are the potential impacts relative to this species.

Foraging habitat lost as a result of the expansion is considered negligible. Since 80 percent of the study area is considered suitable peregrine falcon foraging habitat, the impacts of noise, development and human activity within the project area should not dramatically decrease the value of the Stillwater River as peregrine falcon foraging habitat beyond current impacts.

Two cliff sites in close proximity of the mine are considered potential nesting habitat. The current operation of the mine may have reduced the suitability of these sites for nesting habitat. Additional effects as a result of the expansion are probably minor.

Increased human activity levels in the form of traffic and noise should not reduce the suitability of the historic nest site on the West Fork of the Stillwater River because of the distance from the historical eyrie to the road (approximately five miles).

Based on a review of the proximity of the historic and potential nest sites to the project area and current levels of human use in the Stillwater River Drainage, the SMC expansion should not adversely affect the peregrine falcon.

Gray Wolf

Existing Habitat

No documented records exist for gray wolves in the study area. Although the Greater Yellowstone Ecosystem does not currently support a viable population of wolves, several sightings suggest the presence of this species in and adjacent to Yellowstone National Park. Weaver (1978) states that 81 probable reports involving 109 animals were classified as large canids (possible wolf) between 1968 and 1977.

Additionally, the following observation records of large canid (possible wolf) were provided by U.S. Fish and Wildlife Service (1992) for the vicinity of the project area. Two of these are on the Beartooth Ranger District southwest of the SMC project area. The observation on the South Fork of Grove Creek (T8S,

R20E, sec 35) is located on the Line Creek Plateau. The observation for the Lake Fork of Rock Creek (T9S, R104W, sec 9) is located in the Rock Creek Drainage south of Red Lodge. The remaining observations are a considerable distance from the project area.

Record	Date	Location	Siting
MT 91-245	11-3-91	T8S, R20E, Sec 35 (South Fork Grove Cr.)	Track
MT 89-122	8-3-89	T9S, R104W, Sec 6 (Lake Fk. of Rock Cr.)	Live Animal
MT 91-207	9-15-91	T8S, R6E, Sec 16 (Tom Miner Road)	Live Animal
MT 88-009	5-21-88	T6S, R8W	Domestic wolf hit on highway

Currently, the U.S. Fish and Wildlife Service is preparing an Environmental Impact Statement assessing the potential for reintroducing gray wolves into Yellowstone National Park. There is the potential for wolves to use the project area as the gray wolf population expands either through natural expansion, or reintroduction efforts in Yellowstone National Park. Wolf use in the vicinity of the SMC mine would probably be by transient animals.

Frederick (1991) identifies three components considered important to wolf habitat: 1) a year round basis of ungulates and an alternate prey base, 2) suitable and secluded denning and rendezvous sites, and 3) sufficient space with minimal exposure to humans.

Wolves are tied closely to habitats of large ungulate species, such as elk, moose and deer (USDI 1987). Historically, the lower Stillwater River supported wintering elk. The development of small acreage home sites and mining expansion may have been a factor in the reduction of elk use in the area. The study area does support an abundant white-tail deer population, and mule deer are also relatively common. The Picket Pin elk winter range, which supports up to 250 elk, is located five to ten miles north of the project area on Lodgepole Creek.

The project area, and portion of the study area surrounding the project area, are heavily roaded, and used intensively by humans. Use patterns over the last 40-50 years have probably rendered these habitats unsuitable for wolves. Thiel (1985) and Jensen et al. (1986) document the effects of high road densities on reducing habitat effectiveness for wolves. Outside of the project area, within the study area, habitats do connect to large unroaded areas, such as the Absaroka/Beartooth Wilderness, which would provide suitable habitats for wolves.

Effects

The effects of increased human use above current levels, should not have additional measurable effects on mule deer or white-tail deer habitats above current disturbance levels. The project area currently provides marginal habitat for these species. Habitats outside of the project area will not be modified. No additional roads are planned as a result of the expansion.

Although prey populations may occur in sufficient densities to provide a prey base, the component of wolf habitat relating to "sufficient space with minimal exposure to humans" is currently missing. Thus, the SMC expansion should not adversely effect the gray wolf or gray wolf prey species beyond effects already realized, either within the project or study area.

Harlequin Duck

Existing Conditions

The harlequin duck selects second to fifth order streams that contain swift clean water, and a cobble to bedrock substrate for nesting and brood rearing habitat. Although harlequin ducks have not been documented on the Stillwater River, isolated observations have been made on the Beartooth Ranger District.

The Stillwater River could provide excellent habitat for this species. The river has a low gradient, turbulent reaches, a cobble/boulder substrate, and reaches with shrubby vegetation for cover.

The main limiting factor may be the amount of human use along the River. On the Flathead National Forest, heavy recreation use was corroborated with poor harlequin duck brood production (Carlson 1990). The most valuable remaining habitats lie in the wilderness area above the project site.

Effects

Much of the Stillwater River may have been rendered unsuitable for harlequin ducks by heavy human use along the river. The Stillwater River is a valuable trout fishery, and is a sought out river for fisherman during the time period when the ducks would be nesting and rearing broods. Development of the Stillwater Mine and associated human use may have further reduced the value of the river for this species below the mine.

The additional effects of the SMC expansion should not reduce the availability of nesting and brood-rearing habitat below current levels. Thus, the SMC expansion should not adversely affect the harlequin duck.

As little is know about this species, surveys for this species in the Stillwater River, Rock Creek, Rosebud Creek and their associated drainages would be valuable in ascertaining the status of this species on the Beartooth District. This information could be used to develop a management strategy for this species in relation to other suitable habitats in the Greater Yellowstone area.

Townsend's Big-eared Bat

Existing Conditions

Records exist for Townsend's big-eared bat on the Pryor Mountain Unit of the Beartooth Ranger District. Worthington (1991) captured 11 specimens while working on bat distribution research within the Pryor Mountains. The species is potentially found in the Stillwater River drainage.

Big-eared bats inhabit a wide variety of types from arid juniper breaks to high elevation forests (Kunz and Martin 1982). They are found over much of the western United States. The species uses communal roosts during the winter months and migrates short distances to summer maternity and roost caves. Occasionally, tree cavities are used as nursery roosts. The species will readily use man-made caves such as mine adits and abandoned buildings where these are available (Pierson, pers. comm.). Bats have not been surveyed in the project area. The availability and use of caves in the Stillwater River drainage has not been assessed.

Maternity caves tend to consist of warm, moist caves (Genter pers. comm.). These are typically used from May 15 to September 15. Hibernacula tend to be cooler, drier caves (Worthington 1991). These are used from mid-October through March depending on the severity of the weather (Genter pers. comm.).

Within the project area factors limiting this species include human disturbance, closure of adits potentially providing artificial maternal roosts and hibernacula, and the availability of natural roost sites.

Effects
Habitats in the study area are not considered as valuable as those found within the Pryor Mountains. Limestone derived formations tend to provide caves that are better sites for hibernacula and maternity roosts.

Due to the low probability of roost sites within the project area the SMC expansion should not adversely effect the Townsend's big-eared bat.

Adits created in the project area may provide suitable roost habiat for this species. Prior to the closure of these, they should be inventoried for bats, and evaluated in terms of suitability for providing bat habitat. Adits that are in "hard rock" and in stable condition could be important sites for these species. In addition, the area needs to be surveyed to determine the presence of sensitive bats, the availability of roost sites, and the potential for additional impacts.

Pallid Bat

Existing Conditions
Pallid bats were also documented in the Pryor Mountains. Worthington (1991) captured 17 bats that included juveniles and lactating females. This indicates that maternal roosts exist in close proximity to the Beartooth District.

Little is known about the pallid bat in Montana. This species forages low or on the ground on species such as grasshoppers, crickets, mice and lizards (Genter, pers. comm.). Pallid bats are found in shrub-steppe type habitats with rocky outcrops and desert scrub to ponderosa pine communities.

The species is potentially found in the project area. The lower portions of the Stillwater River drainage probably offer the most suitable habitat due to climate, potential for suitable maternal roost or hibernacula, and availability of foraging habitat. The higher elevations are considered less suitable.

Limiting factors for pallid bats are thought to be similar as those for Townsend's big-eared bats.

Effects
The potential effects of the SMC expansion on the pallid bat are similar to expected effects on the Townsend's big-eared bat. Mitigation and survey needs for the Townsend's big-eared bat are also considered applicable to for the pallid bat.

Spotted Bat

Existing Habitat
Spotted bats were captured and observed at four sites in the Pryor Mountains (Worthington 1991). Spotted bats are associated with arid, desert type terrain and high sedimentary cliffs. The species forages at treetop or higher levels in the late night to early morning hours (Genter pers. comm.).

As with the previous two species, little is known about the spotted bat in Montana. Although spotted bats are potentially found in the project area, the geology and vegetation are not conducive to high quality habitat. Observations and trapping locations in the Pryor Mountains for spotted bats tend to be a lower elevations and are associated with limestone derived caves and arid vegetation communities. As with the pallid bat, the better habitats are probably downstream from the project area.

Limiting factors for spotted bats are thought to be similar to those described for the Townsend's big-eared bat.

Effects
The potential effects of the SMC expansion on the pallid bat are similar to expected effects on the Townsend's big-eared bat. Mitigation and survey needs for the Townsend's big-eared bat are also considered applicable for the spotted bat.

Lynx

Existing Conditions
Lynx have not been documented in the project area. Tracks have been documented on the Shoshone National Forest 20-25 miles south of the project area (Hayden-Wing 1990 cites Reeves et al. 1986). These observations were made in lodgepole/spruce vegetation communities.

Lynx are generally associated with large tracts of boreal forest that contain open areas such as bogs and rock outcrops (McCord and Cordoza 1982). In Montana, the better habitats are most common in the northwestern and north-central portions of the state (Hoffman et al. 1969).

Although lynx populations are often corroborated with snowshoe (*Lepus americanus*) populations, they will also use alternative prey including carrion, small mammals, grouse, and other bird species. Denning sites are generally associated with mature, dense lodgepole pine, subalpine fir and spruce (Koehler and Brittel 1990). Foraging sites include early seral forests and small openings (Koehler and Brittel 1990).

Although lynx could potentially occur in the study area, habitats are generally considered marginal. Approximately 50 percent of the study area is associated with open, rocky grasslands and open conifer stands. Less than 20 percent of the study area is considered suitable for lynx denning and associated foraging (dense lodgepole, aspen, and subalpine fir). Suitable habitats probably exist in the wilderness area, upstream from the project area.

Effects
Lynx habitat within the study area, including the project area, is considered marginal. The expansion of the Stillwater Mine should not adversely effect lynx denning or foraging habitat.

Flammulated Owls

Existing Conditions
Flammulated owls have not been documented on the Custer National Forest. Although, systematic inventories have not been conducted for this species, the study area includes habitat that is considered suitable for nesting. Flammulated owls are associated with mature ponderosa pine and Douglas fir stands with low stand densities and moderately open canopies (Reynolds and Linkhart 1985).

Within the study area, approximately 55 percent of the area could function as suitable nesting habitat. These are open ponderosa pine and Douglas-fir stands. The specific project area contains very little of this habitat.

Effects
The effects of human disturbance on this species are not well documented. Essentially none of the project area remains in suitable nesting habitat for this species. Habitats in the surrounding study area that are considered suitable habitat will not be altered under the SMC expansion. Thus, the effects of the proposed SMC expansion will not adversely effect the flammulated owl or habitats considered suitable for nesting.

If mature ponderosa pine or Douglas-fir stands are entered for the purposes of exploration or future development, surveys should be conducted for this species.

Boreal Owl

Existing Conditions

Boreal owls have not been surveyed on the Custer National Forest. No records exist for the species on the Custer. Inventories for boreal owls in the Little Belt Mountains (Carlson 1991) documented six individuals. Five of these were in lodgepole pine stands, and the remaining one was in a whitebark pine.

Hayward (1989) found boreal owls nesting in mixed conifer, aspen, Douglas-fir and spruce-fir forests. Hayward reported that nesting sites were in older seral stands with open understories and a multi-layered canopy. In eastern Montana, boreal owls may be associated with higher elevation lodgepole pine stands intermixed with meadows (Carlson 1991).

Vegetation communities in the project area are considered marginal for boreal owls. Lodgepole pine and subalpine fir communities total ten percent of the study area. In addition, the structure of these lodgepole stands (mostly small diameter (5-8") would not provide suitable nesting habitat. Habitats upstream from the project area in the wilderness are considered more suitable for this species.

Effects

Since habitats within the project area and study area are currently considered marginal, the expansion of the Stillwater Mine should not adversely effect boreal owl or boreal owl habitat.

Black-backed Woodpecker

Existing Conditions

Black-backed woodpeckers have not been documented within the project area. Although they have not been surveyed on the Custer National Forest, the species is thought to occur in the Greater Yellowstone Area on the Beartooth Ranger District.

This species is associated with concentrations of dead or decaying trees and logs. Often, these sites are found in proximity to recently burned forests. Engelmann spruce, lodgepole pine, Douglas-fir, ponderosa pine, and western larch provide suitable nesting substrates (McClelland 1980 and Degraaf et al. 1991).

Periodic stand replacing fires may be important in providing habitat for this species (Taylor and Barmore 1980), who found that black-backed woodpeckers foraged on snags in open burned areas but nested in adjacent unburned spruce/subalpine fir stands.

Most of the study area is considered unsuitable for this species. Lodgepole pine within the study area is mostly small diameter and is considered unsuitable for nesting. Suitable habitat for this species does exist over much of the Absaroka/Beatooth Wilderness, but is found at elevational gradients above 7,000 feet, in spruce/fir and lodgepole pine habitats.

Effects

Habitats within the project area are currently considered unsuitable for black-backed woodpeckers. The expansion will not render additional habitat unsuitable. Therefore, this project will not adversely effect the black- backed woodpecker, or black-backed woodpecker habitat.

SENSITIVE PLANTS

Sensitive plant surveys have not been conducted on the project area. During the summer of 1990, the Beartooth Ranger District was surveyed by Kruger (1991). Surveys focused on existing plant populations and identifying and surveying habitats that had similar characteristics to those sites. Six sensitive plant species were identified as potentially occurring on the Beartooth Ranger District. Information in this evaluation is derived from their report and Kim Reid, Beartooth District Resources Officer.

Gentianopsis simplex

Existing Conditions

Two populations occur on the Beartooth Ranger District. One population is associated with a bog adjacent to an old beaver pond on East Rosebud Creek. This population was located at 5,460 feet. The other population could not be located, but was previously found on a site associated with a boggy area near a silted-in beaver pond West Rosebud Creek. Prior to the initial development, habitats capable of supporting this species may have occurred in the project area.

Effects

Approximately one percent of the study area is considered riparian drainage bottoms. The project area has been disturbed and it is unlikely that habitat remains for this species. However, since inventories for this species are incomplete, and habitats may exist, any additional areas that could potentially support this species will be surveyed prior to development. A determination of effects on this species cannot be made at this time.

Kobresia macrocarpa

Existing Conditions

One reported known location was surveyed, but the species was not found. This site was a mossy bog at approximately 9,700 feet adjacent to an alpine lake. Habitats considered suitable for this species lie outside of the study area.

Effects

Alpine habitats were not documented in either the study area or project area. The SMC expansion will not effect this species or potential habitats.

Salix barrattiana

Existing Conditions

Salix barranttiana is considered an alpine species. The only known location on the Custer National Forest Is an alpine valley at approximately 9,700 feet. The species grows on gravelly soils overlaid with a peat layer that is moist or saturated.

Effects

Alpine habitats were not documented in either the study area or project area. The SMC expansion will not effect this species or potential habitats.

Selaginella watsonii

Existing Conditions

This species is also an alpine species associated with exposed gravelly subalpine to alpine grass/forb dominated sites. One known location for this species is located on the Line Creek Plateau at 9,930 feet.

Effects

Alpine habitats were not documented in either the study area or project area. The SMC expansion will not effect this species or potential habitats.

Thalapsi parviflorum

Existing Conditions

Thalaspi parviflorum is an alpine species associated with dry to moist granitic soils. Two reported locations were surveyed, but the species was not found. Both sites are above 9 700 feet.

Effects

Alpine habitats were not documented in either the study area or project area. The SMC expansion will not effect this species or potential habitats.

Shoshonea pulvinata

Existing Conditions

Two populations of shoshonea are known on the Pryor Mountains portion of the Beartooth Ranger District. Both of these populations are associated with narrow ridgetops with calcareous, rocky soils derived from limestone parent material.

Effects

Habitat and soil characteristics associated with shoshonea sites do not exist in the Stillwater study area. The SMC expansion will not effect shoshonea, or habitats required by this species.

CONSULTATION WITH OTHERS

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APPENDIX C - RESPONSES TO COMMENTS GENERATED BY DRAFT ENVIRONMENTAL ASSESSMENT

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APPENDIX C - RESPONSE TO COMMENTS

On December 10, 1991, the agencies published a Draft Environmental Assessment on the Stillwater 2000 tons per day proposed expansion. The following substantive comments were received by the agencies during the public comment period which ended January 10, 1992. Agency personnel then responded to these comments. One of the purposes of an EA is to determine if an EIS should be produced. On March 19, 1992, the agencies determined that an EIS was the proper environmental document for this project.

The comments and responses are included in this appendix to help clarify issues and provide information to the public. The reader should note that the responses refer to the EA or Draft EA because the comments were submitted on that document.

Transcripts of December 30, 1991, Public Hearing held in Absarokee, MT. Ten individuals testified at the public hearing.

Comments of Rick Young, Stillwater County Commissioner

T-1. First, we would like to see additional information included, concerning the impact of the expansion of Stillwater's tax base and subsequently our ability to provide services.
Response: Information on the effects of the mine expansion on the property tax base of Stillwater County has been added to the Socioeconomics section of Chapter 4.

T-2. Secondly, the reconstruction of FAS 419 and other related development activities should be more thoroughly discussed. We believe that inclusion of more specific details in these two areas will make the EA a more complete and defensible document.
Response: Comment noted. This information will be included in the final document.

Comments of Kathryn Hicks

T-3. The Stillwater Mining Complex shouldn't be allowed to expand operations unless and until guarantees can be made and met there will be no degradation of water quality, either on the surface or underground. Achieving this requirement should simply be considered as one of the costs of doing business. The general population shouldn't be expected to absorb the cost of health hazards, in order to ensure a company's profits.
Response: The EA concludes that human health would not be adversely affected, nor would existing beneficial uses be precluded by the proposed expansion. In addition, the Water Quality Act requires the proposed activities and alternatives to protect human health and beneficial users.

Comments of Richard Parks, Representative
Northern Plains Resource Council

T-4. It is clear that this document is intended not to enforce that {nondegradation} rule but to evade it.
Response: A major portion of the EA is devoted to addressing water quality impacts, including nondegradation. Degradation was not an issue during public scoping. The agencies identified degradation and addressed it in the EA. Nondegradation is not a rule' rather it is a process defined in the Water Quality Act.

T-5. It is also well known that this process is intended to set just that precedent, with several other degradation applications waiting in the wing.
Response: This process is not intended to set precedent since other petitions have been considered by the BHES. Each petition will be considered on a case-by-case basis. Three additional petitions are currently before the Board of Health and Environmental Sciences.

T-6. The Environmental Protection Agency notified the State over two years ago that the State's rules did not conform to the federal Clean Water Act requirements.
Response: The EPA notified the state of Montana on March 8, 1989 that they were unable to fully approve sections of the water quality standards and nondegradation rules as the EPA is required to do under the Clean Water Act (CWA). Under the CWA, EPA was to promptly propose federal standards if the state does not change its rules within 90 days. The state responded to EPA on June 8, 1989 indicating that the disapproved sections do meet the requirements of the CWA and the state did not intend to change in these sections. No further action has taken place.
Authority for the Montana's water quality standards including the nondegradation rules comes from the Montana Water Quality Act and does not require federal approval for state implementation. A state water quality standard remains in effect even though disapproved by EPA until the state revises it or EPA promulgates a rule that supersedes the state standard [40 CFR 131.21(2)(c)].

T-7. At the same time the State does not appear to be willing to act within their own rules. We have been engaged in a dialogue for some months with the State trying to unscramble what their rules mean.
Response: The comment does not refer to any specific section(s) of the rules that have not been complied with. The WQB believes that all sections of the water quality rules and environmental policy acts have been complied with to the fullest extent possible. What may not be clear to the commentor is how the nondegradation rules apply to other activities, such as residential septic systems, nonpoint source pollution and other activities. However, it is clear that the nondegradation rules do apply to the proposed SMC expansion. For these reasons a petition, environmental impact analysis, and public hearing before the Board are required.

T-8. In the meantime will you as you should hold off making decisions to degrade water until after your rules are in order and the proposals can conform to those rules.
Response: The BHES considered a request to suspend the nondegradation process at the January 24, 1992 meeting, and determined the rules in question did not affect the process. Therefore, there are no plans to delay decision making. Water quality standards are revised and updated every three years. This process is scheduled to occur again in 1992 and again in 1995, etc. Any change(s) currently being considered for the 1992 revision is not expected to substantially affect the current process, other than procedural clarification.

Comments of Jeanne Souvigney,representative of the Greater Yellowstone Coalition

T-9. One was the statement that reclamation success is currently permitted is questionable.
Response: The term questionable was meant to refer to state-of-the-art, which has changed considerably since the permit was first issued. The 1985 analysis of the original plan still stands. However, the agencies believe the plan and final reclamation can be

improved upon. The agencies chose to revaluate the existing reclamation plan as part of this amendment application process. The existing reclamation plan approved in 1985 was evaluated and judged to be inadequate based on 1992 reclamation practices. The existing plan was improved by increasing soil salvage requirements. The agencies used the EA process to allow for full public disclosure, even though in this case of modifying the reclamation plan it was not required by law.

T-10. We understand that current monitoring wells are not sufficient to assess off-site impacts north and northeast of Stillwater Mining Company's permit boundary. Why wasn't this addressed in the annual monitoring reports that we have been reviewing, in the past, the last one issued in March that we saw?
Response: The SMC annual monitoring reports are the company's annual submission of monitoring data to the agencies. Opinions expressed in the monitoring reports are those of the company. It is the agencies' responsibility to assess this information and determine compliance with permit conditions, and state and federal statutes.

T-11. We have concerns that some of these issues are only brought up in the context of new permits. We would like to have more faith in the agency's ability to address these issues.
Response: Mines are inspected regularly by the agencies. Annual reports covering water monitoring, reclamation activities and other topics are published by SMC and reviewed by the agencies. Regulating mines is an on-going process as shown by the changes in the reclamation plan which have already been instituted. Although agency files are current, we have taken this opportunity to inform the public of changes which have been occurring. This does not mean this issue has not been addressed.

T-12. Our concern is: it's not real clear when you look at the EA just how much traffic we can expect on that highway, and I have talked to the Forest Service prior to this about meeting just what that table meant, and whether in fact for example the exemption of people within 10 miles of the mine was included in that table.
Response: This table shows the current number of vehicles (364 employees at 3.0 employees per vehicle), and displays the potential number as employment increases, and if the 3.0 mitigation restriction were removed. Table 4.4-1 in the Traffic discussion does include the personnel living with 10 miles of the mine complex. The alternative chosen by the decision makers will determine the number of mine related vehicles per day (or per shift), and the impact they will have on wildlife and other non-mine related traffic.

Comments of Gary Ferguson

T-13. Specifically the Noranda Proposal and their request for water quality exemption and the potential impacts on the Stillwater River when put together with exemptions for the Stillwater Mine could result in degradation of significant concern.
Response: The Crown Butte (Noranda) proposal at New World does not include a petition for Daisy Creek which is the headwaters of the Stillwater River because they are not proposing any facilities in that drainage. Crown Butte's mine calls for surface mining the

low grade ore deposits in the historic McLaren and Como pits which are producing very acidic conditions. Mining the McLaren pit would remove much of the source for existing conditions, thus, improving water quality of the Stillwater River at its headwaters.

T-14. I believe technology does exist, not only to monitor water quality in the Stillwater Mine and other projects, but also treat water in such ways that the system is not degraded. And I think it should be a strong and stringent requirement that technology, no matter what the cost, be put into play so that mining can occur and water quality can be maintained.
Response: The EA does discuss three forms of advanced treatment which, in combination with the present water treatment, would maintain the water quality at current levels. The BHES will consider these options in making a final decision. The technology used to monitor water quality is discussed in the response to comment __ (Milligan # 4).

Comments of Jim Milligan, Chairman
Stillwater Protective Association

T-15. But to me the water quality exemption is the foremost issue. The original environmental impact statement said water quality would be unaffected.
Response: The Stillwater EIS (DSL/USFS, 1985) documented increased nitrate and total nitrogen in the groundwater near the mine (page III-13). The EIS concluded that nitrogen concentrations would continue to increase but would remain below drinking water standards (Page IV-7) and nitrogen concentrations in the Stillwater River would not be influenced by the percolation ponds (IV-8). Monitoring results, summarized in the EA (Chapter 3) substantiated these conclusions.
The FEIS also concluded the mine would not have adverse effects on the aquatic ecology (algae and aquatic insects). However, no biological monitoring was required and therefore no definitive conclusions can be drawn. Since water quality has been maintained it is likely that these predictions are also correct. Substrate (river bottom) monitoring has not demonstrated any change in sediment characteristics. Under Alternative 5, an in-stream biological monitoring program would be required. Although the original predictions are correct, a doubling of production may impact water quality and therefore an additional environmental analysis was completed.

T-16. Stillwater Mining Company must treat the water before it discharges into the river and into percolation ponds or irrigation system to prevent any water quality degradation.
Response: SMC applies conventional treatment to adit water before discharging to percolation ponds. No surface water discharge is planned. Additional treatment for removal of metals would be necessary before discharge to the Stillwater River. Advanced treatment may be required to prevent degradation.

T-17. More sensitive water testing analysis, such as a mass spectrometer test for example, should be used to determine true baseline water conditions or potential violations before any exception is granted.

Response: Procedures using Inductively Coupled Plasma - Mass Spectrometry (ICP-MS) and Graphite Furnace Atomic Absorption Spectrometry (GF-AAS) were used to determine baseline and are used by SMC and the WQB for monitoring. Under Alternative 5, the company would be required to use lower detection limits for routine monitoring.

T-18. Additionally, the Board of Health, should invoke its emergency powers to suspend any decision on SMC's petition until the Water Quality Bureau has resolved the deficiencies in the State's water quality rules disapproved by the Environmental Protection Agency.
Response: The Department of Health and Environmental Sciences not the Board, has emergency powers. These emergency powers can be invoked after a finding of substantial pollution or injury (75-5-621, MCA) or endangerment of health, welfare, or livelihood (75-5-622, MCA). This is clearly not the case.

Comments of Trudy Shunk

T-19. Let me quote from that March 1989 document {East Adit Plan} "Long-range needs to increase production could result from an increase in metal prices as well as shortages in the world market; however, no such plans are known for the near future." Tonight we are a little over 2 1/2 years into that near future and the price of metals is dramatically low and reserves of platinum on the world market are dramatically high, so why are we considering an evaluation of a proposal to double production of these metals?
Response: The agencies are considering this proposal because they are mandated under both state and federal law to do so. SMC's timing of this submittal is probably based upon the length of this permitting process, and construction/development periods (approximately 2 years) so that SMC would be postured to take advantage of price increases about 3 years in the future.

T-20. This eighth amendment is the latest in a series in what is commonly being called, referred to as the creeping amendment process.
Response: No business of any kind is expected to survive by developing a plan and then carrying it through without change for 25 years. Changes and relocation of facilities between preliminary and final engineering is very common. Businesses grow and adapt operations to changing knowledge or circumstances. Tiering language in NEPA (40 CFR 1528.28) and adopting language in MEPA recognize change when it speaks of an EIS at early stages followed by subsequent environmental review.

Of the seven amendments to the original EIS which is approximately one change per year) 2 relocated approved facilities with no increase in permitted areas, 2 allowed borrow areas within the permit area, and 1 allowed construction of a temporary sand slurry line across the river. Only two amendments increased the permit area: amendment 005, known as the East Side Amendment, increased the permit area by 608 acres (including 72 acres of disturbance) by allowing adits and facilities on the opposite side of the river, and amendment 007 allowed new percolation ponds and monitoring wells with a 27 acre increase in permit area, and 7 acres disturbed. Each amendment was reviewed under

MEPA/NEPA and MMRA and public comment was extensively solicited for the East Side Amendment. All reviews have considered cumulative effects and are open to the public. In the meantime, SMC has reclaimed acreage and has improved plans in the effort to reduce other permitted disturbances so that total disturbed acreage is almost the same as originally permitted.

T-21. We have already seen what can happen when a company wants to be relieved of certain a mitigation measure {Sic}. The threat of legal counsel, the DSL, and the Forest Service to then mitigate the mitigation measure. So now we not only have the creeping amendment process, we have the vacillating mitigation process.
Response: Mitigations can and should be modified based upon the severity of the impact as determined by the monitoring and enforcement programs (40 CFR 1505.2(c)). The potential change in mitigation was addressed in the EA in order to provide for an opportunity for public comment. It is assumed that the public would provide comment on the rationale for increasing or decreasing the intensity of mitigations and to provide suggestions for reasonable alternatives if such is waived.

T-22. I believe that the public should demand that the company be mandated to use the best available technology to treat all waste water from the mine and to use the best available technology to detect and to test for contaminates in the surface and ground waters.
Response: SMC applies Best Available Treatment (BAT) technology as discussed in the EA. Advanced treatment is discussed in the EA and may be necessary. See Milligan #4 for monitoring.

T-23. The company should be required to upgrade their procedures as new technologies are developed in the future, throughout the life of the mine.
Response: This requirement results in amendments and changes in mitigations. The agencies do require such upgrades.

Comments of George Rossetter
Fishtail, MT

T-24. Recently I read that despite many studies {Upper Clark Fork River} and thousands of dollars expended on reclamation, the water is still polluted. Tonight as the lowering of water quality is discussed, I am reminded of that old adage as follows, "One who ignores history is doomed to repeat it."
Response: Fortunately, Montana and the nation have not chosen to ignore our history. We have passed literally hundreds of laws regulating man's activities in the environment. Some of these laws which direct our actions in this document are: National Environmental Policy Act, Montana Environmental Policy Act, Montana Metal Mining Reclamation Act, Clean Water Act, Clean Air Act, Montana Water Quality Act, the Endangered Species Act, the Historic Preservation Act, the Multiple Use Sustained Yield Act, the Wilderness Act, almost ad infinitum. Since reclamation and stabilization efforts commenced about 20 years ago, that section of the Clark Fork has become quite an acceptable fishery.

Comments of Mona Jamison, Attorney Representing
The Mikelson Land Company & Cathedral Mountain Ranch

T-25. You have heard from the Water Quality Bureau a definition of what nondegradation is: as being to protect beneficial uses; and as a process by which through the waiver process before the Board of Health, to prevent the cumulative impact of incremental degradation such that water quality standards would ultimately not be violated... For the record I disagree with that. Nowhere in the statutes what so ever in the water quality act or in the rules is that interpretation supported.
Response: Correct. The Water Quality Act states that any state water whose existing quality is higher than the established standards shall be maintained. There are many good reasons for maintaining water quality at those levels. The discussion presented at the public meeting was intended to focus on process and not the justification for maintenance of water quality.
However, the protection of (beneficial) uses is fundamental in both state and federal nondegradation (anti-degradation) statutes. (75-7-303, MCA and 40 CFR 131.12). Water quality standards are developed to protect beneficial uses.

T-26. Another reason for an EIS-baseline data should be from 1985. The data that this proposal, amendment number 8, should be compared to in terms of discerning what impacts are, should be to 1985.
Response: Analysis is based upon the existing environment and tiered to the 1985 EIS. All available data was considered in this document and is on file for public review.

T-27. "Numeric water quality standards will not be exceeded by the petition, human health and aquatic organisms will not be negatively affected if the petition were granted:"...Therefore, the waiver of nondegradation does not constitute a significant impact...It is our opinion the water quality standard which was established for every reach of Montana waters set classifications which protect the beneficial uses. There is in the law, not in the rules, but in the law passed by the legislature, a nondegradation provision which speaks to pristine waters-waters whose existing quality is better than the standards that have been established for that stream. I maintain that is in-of-itself a standard.
Response: Classification and standards are adopted pursuant to Part 3 of the Water Quality Act and includes the Nondegradation Policy (75-5-303, MCA). Therefore, the nondegradation policy and implementing rules are considered as a water quality standard.
The nondegradation policy, expressly allows the board to authorize degradation of state waters "when it has been affirmatively demonstrated to the board that a change is justifiable as a result of necessary economic or social development and will not preclude present and anticipated use of these waters". Granting of a petition in accordance with 75-5-303, MCA, is part of the law and does not violate the nondegradation policy or standards. Significance, of a board action on a petition to degrade state waters must be evaluated under the same MEPA criteria as other state actions. These criteria focus on the environmental impacts of the proposed action.

T-28. ...the federal government under the federal clean water act that actually had a 1985 standard for no discharges into any federal waters. That still has not been amended by Congress.

Response: The federal Clean Water Act (33 U.S.C. 1251 seq.) (CWA) sets forth the nation's goal of restoring and maintaining the "chemical, physical, and biological integrity of the Nation's water". Section 101(a)(3) of the CWA prohibits the "discharge of toxic pollutants in toxic amounts". The proposed expansion complies with and is consistent with the federal CWA.

T-29. There is no independent analysis made in this document. And, in fact, page 117 suggests that actual effluent limits would be developed after the board acts on the petition.

Response: MEPA requires that the agency shall prepare an Environmental Assessment (ARM 16.2.628). There is no requirement for an "independent analysis".

The EA correctly states that actual effluent limitations would be developed by the DHES-WQB after the Board acts on the petition. The state's nondegradation policy empowers the board to make decisions on degradation of state waters. The DHES-WQB is responsible for implementing those decisions and for administering of the MPDES program.

T-30. Yet there was no perspective as to the total social cost and benefit which has to do with quantifying the impacts on the environment, which is done by the utilities. Why shouldn't this company be held to the same test?

Response: This level of economic analysis has not been performed nor is it required under MEPA or the Water Quality Act or rules. The utilities are permitted under the Major Facility Siting Act which has its own rules for implementation. If that analysis had been contemplated for the petition process, the legislature could easily have specified that similar rules be adopted.

Written comments received in response to the Environmental Assessment for the Stillwater Mining Company. Comment period ending January 10, 1992.

Representative Jim Southworth Letter #1 and 2
Montana House of Representatives

1-1. SMC is required by the Montana Water Quality Act and the federal clean water act to maintain the present water quality on the Stillwater River for both surface and ground water.

Response: SMC may petition the Board of Health and Environmental Sciences to allow some degradation of state waters as long as the degradation will not preclude present and anticipated uses (75-5-303, MCA). Both state and federal regulations recognize this requirement. The EA presents advanced treatment alternatives that will maintain water quality. The Board must issue a decision on degradation which the WQB will administer.

Stillwater County Commissioners Letter #3
Columbus, MT

3-1. The levels of impact identified in the Mine Expansion 2000 TPD Draft EA will not necessarily result in an amendment to the SMC Hard Rock Mining Economic Impact Plan. Therefore, it may be erroneous to conclude that mitigation measures contained in the amended Impact Plan will be applicable to all socioeconomic impacts.
Response: It is acknowledged in the Draft EA that the mine expansion will not necessarily trigger an amendment to the Hard Rock Mining Impact Plan. (See Chapter 4, page 155, next to last paragraph.)

Robert Howard Letter #4
Norman, OK

4-1. Is it economically feasible to reinforce the toe dike with concrete to reduce the possibility of erosion during high water?
Response: Parts of the toe dike are currently armored with riprap to protect the dam against design flood events. Riprap protects the dam by resisting the shearing and lifting forces during flow, and filter layers prevent turbulent infiltration and subsequent erosion of dam materials by piping. A concrete face may be more susceptible to lift by fluid flow than individual boulders in riprap, because of the larger area exposed to the pressure differentials of fluid flow along a boundary.
The present location of the toe dike with respect to design flood levels is reasonably mitigated with the riprapped armor. Further intrusion into the flood plain may not be feasibly mitigated by larger riprap or a concrete dam, due to both economic and engineering criteria.

4-2. Ch 1 pg 3 Did allowing the railroad to be constructed not require an amendment?
Response: No, it was included in the original proposal and addressed in the 1985 EIS.

4-3. Ch 2 pg 40 footnote to Table 2.3.4 "Value shown is the analytical detection limit." I would suggest "Value shown is the standard analytical detection limit. Smaller values can be measured with more sophisticated detection equipment.
Response: The Water Quality Bureau does not agree. 'Standard' detection limits for some parameters may be lower than those presented in Table 2.3-4. Detection limits are specific to individual instruments, procedures and sample matrices, and therefore, standard detection limits are not easily defined. The WQB does agree that lower detection limits are achievable for the sample matrix being analyzed. The EA uses these lower detection limits based on more recent samples to analyze the petition. The agencies have proposed lower detection limits for routine monitoring under Alternative 5 (agency mitigation).

4-4. Ch 3 pg 61 The statement that "...the project area has a 90% probability of not exceeding a peak particle acceleration of 20% of gravity in 50 years" could be read as "There is a

10% probability of exceeding a particle acceleration of 0.2 g in 50 years." Since the tailings will remain for all time, this seems like a significant danger.
Response: The discussion on page 61 regarding the probability of exceeding a set particle acceleration specifies "peak" particle acceleration. It is important to realize that the average or sustained particle acceleration is considerably less than an instantaneous "peak". The statement can be interpreted as a 10% probability of exceeding a peak particle acceleration of 20% of gravity in 50 years. The dam has been designed to withstand a seismic event of that magnitude.

4-5. Ch 3 page 61 Having observed sinking of gravestones during an earthquake in Chile, I question that "the tailing mass would not be expected to flow." Liquefaction of sediments by ground vibrations is a well-document phenomenon.
Response: The third and fourth paragraphs on page 61 are intended to inform the reader of the possible consequences of dam failure. The discussion on page 61 is similar and related to the statement that occurs in the first paragraph on page 108. Neither discussion suggests that the saturated tailing mass would not be subject to liquefaction. Stability analyses account for a potential loss of shear strength due to vibration by conservatively assuming zero internal friction in the tailing mass. The text correctly describes the dam as not being subject to liquefaction. Mass stability of the dam has been appropriately analyzed. Foundation investigations have indicated that displacement in the dam due to rupture (faulting) in the foundation is highly improbable. The recurrence interval of the one-half and full probable maximum floods are estimated at 10,000 and 30,000 years, respectively.
Seismic liquefaction of the impounded tailing mass occurring coincidentally with the other improbable means of dam failure may be statistically possible, but unreasonable for design criteria.

4-6. Ch 3 pg 91 Table 308-3 Why is the total under Montana greater than 100%?
Response: Total government labor income consists of the sum of the federal civilian, federal military, and state and local components. Thus, in computing the total, one should not add the percentages for both the individual components and total government, since that results in double counting.

4-7. Ch 4 pg 125 "Applicable water quality standards would be maintained for class B-1 surface water and Class 1 ground water." Does this constitute nondegradation?
Response: Yes. Degradation is defined as any lowering of water quality even though numerical water quality standards would not be exceeded.

4-8. Ch 4 pg 145 "As part of the air quality permitting process, SMC must submit verification through computer modeling that the increases in emissions will not cause exceedance of an ambient air quality standard." After studying these computer-modeling studies in some depth in connection with the SMC smelter proposal, I am convinced that these studies are next to worthless. I think the only meaningful numbers are the amounts of gaseous and particulate matter emitted.

Response: Computer simulation modeling of air pollutant emissions is a predictive tool to aid in the air quality permitting process. In a complex terrain setting such as at SMC, the results definitely become less accurate, but are assumed to represent a worst-case analysis. The estimated amounts of air pollution emitted from the operation are indeed important and these are included in the EA.

4-9. Ch 4 Table 4.5-1 Won't some of the "Chemical Stabilizer" used to cut down dust from roads wash into the river?
Response: With proper application of the chemical stabilizer (generally magnesium chloride) there should be no contamination of nearby water resources, either surface or groundwater. Proper application includes such things as good road bed preparation, controlling application rates, not applying too close to bridges, etc.

4-10. Ch 4 pg 150, 4.7.5 "...and veil operational lighting from the rest of the valley at night." From my home, I look into a sea of these lights. During the last 2 years, I have spoken at least twice to SMC personnel who assured me that hoods would be placed over the lights. This would cause no decrease in ground lighting and possibly increase it while cutting off direct light to my home and others in the valley. Thus far, this has not been done.
Response: SMC has committed to work with effected landowners to address this situation. Lights have been hooded within safety limits.
SMC has no record of being contacted by Mr. Howard, and has attempted on two occasions since receipt of this letter to phone him, but have been unable to reach him. (Jim Richter, personal communication, 1992)

Robert Wallace, Geologist Letter #5
Nye, MT

5-1. My investigations gave strong support to the opinion I had expressed earlier; that is, that a very real potential exists for strong earthquakes in the Beartooth Mountain region. Such earthquakes are likely to occur only infrequently, but Magnitude 7 earthquakes are not out of the question at any time. Unfortunately, the needed investigations are extensive as so few studies of the fundamentals relating to late Quaternary geologic history of the region have ever been made.
Response: The extent of seismic probability studies, the design criteria selected, and the construction method implemented at the SMC tailing impoundment are well within currently accepted industry and engineering standards. See response to Howard letter, question 4-4.

Yellowstone Audubon Society, Letter #6
Kathryn Hicks

6-1. The headwaters of the Stillwater River were in an essential pristine condition at the start up of this operation and all available technology should be required to keep them so.

Response: The headwaters of the Stillwater River are about 30 miles upstream of SMC. Daisy Creek, one of the headwaters creeks, is highly acid and devoid of fish or macroinvertebrate life.

Mona Jamison, Attorney Letter #7.
Helena, MT

7-1. Not only is the increased tailing capacity "reasonably foreseeable, " but is an economic necessity, inextricably related to and part of the SMC 2000 proposal .
Response: This is a supposition on the part of the reader. Many factors contribute to the life expectancy of the impoundment. The 1985 EIS predicted that capacity would be reached in 2009, but actual operations seem to have extended that date to 2013 at 1000 tpd. Future operational changes could possibly reduce the amount of tailing and extend that date. The actual economics are that expansion of facilities is far cheaper than building new ones. Mining becomes more expensive the farther underground one goes. A new impoundment would cost about $20 million at today's prices. Operational costs would increase for an impoundment at a different location. SMC will decide at some point in the future whether a new impoundment is economically feasible. If it is, an application will be submitted and a full environmental review will occur. Please see Section 4.1 for discussion of impoundment capacity, and SMC comment 9-19 for further clarification.

7-2. Pg.14 Sect.1.8.3: Tailing pond modifications and increased traffic would impact the Bighorn sheep. It would eliminate current forage for wildlife.
Response: Correct. That is the rational for the mitigation measure displayed in section 4.4.6. The intention is to draw the sheep away for the mining area, thus drawing them back to the historic "core" winter range.

7-3. Pg. 14 Sect.1.8.4: Additional underground blasting will be required which could alter existing aquifers and flow patterns. Springs or creeks may dry up as in the case of the Stillwater Valley Ranch.
Response: Surface water resources on the East Side have been impacted by underground development at SMC, and further development and production will likely have similar impacts. Please refer to the applicable discussions in Sections 3.1.1 Geotechnical, 3.2.3 Adit Water and 4.2.1 Hydrologic Consequences of the Alternatives Being Considered. The reader is correct in that groundwater flow into the mine is, in part, supplied by surface water resources. Interception of water-bearing structure by mine openings may cause springs or streams to dry up.

7-4. CMR has also had indications that springs have been affected and lakes within CMR are at lower levels.
Response: Springs tested on the West Side of the Stillwater River have indicated little flow fluctuations since monitoring began. Given the generalized drought conditions which have existed in the Greater Yellowstone Area from 1987 to 1990, it stands to reason that somewhat reduced spring flow or lake volumes are being noticed at CMR. Observations of

spring flows across the Beartooth District indicate similar flow patterns. Additionally, domestic consumption within the CMR area may contribute to the observed situation. Although the agencies previously have not been notified of any such occurrences they would be happy to consult with CMR's hydrologists to help design a study to ascertain if water levels are indeed at lower than baseline levels prior to subdivision, and then determine if the possible lower levels were due to recent droughts, pumping from CMR residents or some other cause.

7-5. Pg 19. Sect.2.3.2: Blasting will increase with 2000 tpd and will itself be an additional negative impact. Increased noise and possible interception of springs may occur.
Response: Comment noted. Please refer to the response to comment 7-3 above.

7-6. Pg.20 Sect. 2.3.6: Waste rock and materials will be hauled to the west side tailings pond and mill, creating additional traffic and noise impacts which have not been accounted for or mitigated.
Response: The project area lies within Management Area "E" as stated in the Custer Land and Resource Management Plan (1986). The goal for this management area is to encourage and facilitate mineral exploration, development, and production. Traffic mitigation within the management area would interfere with implementation of this management area's goal. Additionally, Stillwater County residents who expressed concerns related to mine traffic lived in the vicinity of Fishtail, MT. Since this type of mine related traffic would be confined within the permit boundary, no impacts to individuals who expressed concerns are anticipated. Currently, SMC's traffic policy is to yield the right-of-way to non-mine related traffic. This traffic policy will remain in effect. Currently, most of the east side waste rock is hauled to the west side for construction of the tailings impoundment. As shown in Appendix A of Addendum B of the 2000 TPD expansion proposal, although tons of ore produced would double by 1996, tons of waste produced is anticipated to increase by only 12% (from the current 300,000 TPD waste to 335,000 TPD waste). Some of this material would be used for construction of berms on the east side, further reducing the amount hauled to the west side. This is not anticipated to have an increased impact on traffic and noise. Noise impacts have been determined to be negligible. Traffic would not increase on FAS #19 because vehicles would not be travelling on the road, only crossing it. With the regulations and stop signs already in place, the agencies do not anticipate any safety hazard.

7-7. Pg.21 Sect. 2.3.7.3: Interception of large amounts of water which have been stored in faults and fractures will periodically occur. This has a continued impact possibility on CMR and other areas. SMC should be required to notify nearby landowners when this "interception" occurs.
Response: There is no legal requirement that landowners be notified of interceptions.

7-8. Pg.23 Sect. 2.3.9: The new mill access road will be a new addition on north end of existing mine water overflow pond. This will create more traffic and congestion on highway to Woodbine, etc.

Response: If the mill access road is relocated, the mill access traffic associated with that will also be relocated, not increased due to the relocation. See answer to question #18 above for discussion on east to west haulage. Traffic will be handled as currently permitted.

7-9. Pg.23 Sect.2.3.10: How much additional equipment, trucks, front- end loaders, etc. will be required on each side, if SMC 2000 is permitted?
Response: The estimated increase in mine support vehicles is displayed within the amended Plan of Operations on file with the regulatory agencies. For the type of equipment which you have expressed interest in a range between 178 to 247 is indicated within the amendment. The amount of this type of equipment currently in use at the mine is ?????. Of the anticipated increase in equipment/vehicle, 1/2 would be utilized on the West Side of the Stillwater River, the remainder would be used on the East Side of the Stillwater River. As discussed in the proposal, the exact number of pieces of equipment will be influenced by unpredictable changing mining conditions. The total number of trucks, front-end loaders, etc. is shown on Table 3.2-1 of the 2000 TPD expansion proposal.

7-10. Pg.24 Sect.2.3.11: How large does the new building on the west side <u>need</u> to be in order to accommodate mill expansion?
Response: SMC has a better understanding of what the size of the proposed new building "needs" to be than does the agencies. The location of the facilities as proposed is reasonable, and the agencies do not believe it necessary to redesign the layout.
Refer to site location map 2.3-1.

7-11. Pg. 25 Sect. 2.3.12: Another borrow pit on Stratton Ranch will be necessary for the 2000 tpd requested.
Response: If the tailing impoundment height were raised, additional liner would need to be placed, requiring additional bedding material. This could mean that a new borrow site would need to be identified. However, other on-site materials such as sand plant product might also be used, and thus, borrow material would not be necessary.

7-12. Pg. 25. Sect. 2.3.13: SMC indicates they will need another security office on the east side due to expansion. This will produce yet more lights and activity.
The cumulative impacts on the east side and Stillwater Valley Ranch will affect CMR and most aspects of the physical and human environment as defined by MEPA. Again no mitigation is required for these impacts.
Mitigation of these impacts must be required and should include design relocation to the west side so as to minimize new and additional impacts caused by east side development.
Response: No activities at Stillwater Valley Ranch have been proposed in this amendment. The increase in lights and other activities were previously permitted (but not yet built) and the cumulative effects of this amendment are considered minor or do not require mitigation.

7-13. Pg.32 Sect. 2.3.18.5: The proposed east side waste/berm screen will be done over a period of 5-6 years. It is useless to CMR, as numerous CMR lots and residences will be

looking down into the area. Also during these 5-6 years, the east side development will severely impact land values, sales, and the use and enjoyment of CMR properties.
Response: CMR's perspective of the visual screening berm will be considered in decision-making since the agencies' preferred alternative would not have material available to build it. However, it is unclear to the agencies that if the berm is useless, how after the berm is built, no more economic loss to CMR will occur.

7-14. Pg. 36 Sect. 2.3.18.8 & 10: The "present plan" states that all surface facilities will be removed during final reclamation. However, SMC will have the option "if it is beneficial" to leave structures associated with the mine in place after closure. Who makes this determination?
Response: If the facilities are on private land, they are the private property of SMC and the company will make the determination. If the facilities are on Forest Service land, the Forest Service could request that the building be left for an alternate, post-mining use by the Forest Service which would be compatible with the forest plan.

7-15. Pg. 37 Sect.2.3.18.11: The section states that the "underground workings" will continue to produce water drainage after mining activities cease. SMC, - a successor, or whoever, would be responsible for any necessary monitoring, maintenance, or reclamation after expiration of the DHES permit. Do the Stillwater Valley residents and homeowners inherit this ongoing and permanent impact?
Response: No. It is clearly stated that SMC is responsible. "Any successor" refers to any person or entity which might purchase the property, and would also assume SMC's liabilities and responsibility for maintenance or reclamation.

7-16. Pg.37 Sect. 2.3.8.12: SMC estimates 1.7 million for reclamation costs.

1. Does this include SMC 2000? Does it address future amendments? By when?
2. When was the 1.7 million reclamation cost developed?

Response: See Section 1.5.1, last two paragraphs. Bonds are calculated after the decision on the amendment is rendered. The present bond is $1,477,000 and was evaluated after the last amendment was approved. The bond will be based upon the alternatives selected.

7-17. Pg.38 Sect.2.3.3: Three off-site springs are not adequate for monitoring. Further, they have not been located on a reference map and should be.
Response: The proposed expansion does not call for mining any new areas but increases the rate of mining. Therefore, it was not considered necessary to include additional monitoring sites. The legal descriptions of these springs are provided in Table 2.3-3. These sites are located on Figure 3.2-1 - Monitoring Site Locations.

7-18. Pg.48 Sect.2.6.1: Existing monitoring programs by SMC are not adequate for detecting contamination at lower levels.

CMR lakes and Horseman Flat Lake should also be monitored as well as adjacent springs supplying CMR and other Stillwater Valley areas.
Groundwater monitoring on west side indicates nitrates are already elevated north of permit boundary.
SMC also indicates that the area northeast of boundary is not monitored and no data is available as to what degree of pollutants are present. Monitoring should be required here also.
Response: Reference to 'contamination' in section 2.6.1 of the EA concludes that monitoring is adequate to detect contamination but lower levels may be achievable. Groundwater monitoring on the west side indicates that nitrates levels are elevated within the property boundary in the vicinity of MW- 7/9/11.
Groundwater is monitored on the north-east property boundary and is discussed in Chapters 2, 3, 4 and 5.

7-19. Pg.49 Sect. 2.6.2:SMC is to provide a specific plan for reclamation of the tailings pond by January 1, 1993.

1. How can SMC legally receive a permit prior to approval of its "Reclamation of Impoundment Plan"?
2. How does DSL reconcile this condition with the requirements of Title 82, Chapter 4, Part 3, MCA?

Response: A reclamation plan is in place and is bonded. SMC's reclamation efforts have shown that reclamation success is possible with limited soil salvage. The new plan to be developed will increase the level of reclamation success.

2. The agencies see no need to shut down an operation while a supplemental plan is being developed.

7-20. Pg. 49 Sect. 2.6.3: Why would a plan for more detailed monitoring of waste rock types and volumes be delayed until after permitting? Again, how does DSL reconcile this "future condition" with the requirements of Title 82, Chapter 4, Part 3, MCA?
Response: The Stillwater Mine, through previous testing, has never been found to produce acids. The mine and the agencies have, and will continue to, test material for acid generation. This mitigation is a formalization of the process.

7-21. Pg.51 Sect. 2.6.7: There should be no exemptions for employees living within 10 miles of SMC for vehicle mitigation. The traffic hazard will be increased with SMC 2000 anyway.
Response: As discussed in Chapter 4 Traffic, there are 56 employees currently living within 10 miles of the mine site. This number is not expected to increase with the mine expansion. If the 10 mile exemption were granted, many of these employees would be expected to continue carpooling among themselves as they are now for their own economic reasons.

7-22. Pg.53 Sect. 2.7.1: The cumulative effects of programs like M104, M105, and M106 are examples of why elk no longer enjoy and use the habitat at CMR and adjacent areas.

Response: The agencies do not have any biological documentation to support this conclusion reached by CMR. As discussed in Chapter 4 Wildlife, elk do not use the mine permit area. Mining impacts on the elk population are therefore minimal. The effect of these programs (M104, 105 and 106) on elk are beyond the scope of this document.

7-23. Pg.58 Sect. 2.7.3: Chrome Corp. and International Platinum are not included as possible cumulative impacts in this document and, in fact, have been eliminated as such. Since they both have extensive claims, patents, and real estate in this proximity, they should not be summarily dismissed, but should be thoroughly analyzed in the cumulative impact analysis. In the opinion of DSL and the USFS, what would make either project reasonably foreseeable? Is there any exploration ongoing at all at either of these projects?
Response: International Platinum no longer exist as a corporation, and holds no claims in the Stillwater Complex. Chrome Corporation of America continues to scale back exploration activities. At this time there are not any Plans of Operations on file from CCA in or adjacent to the Stillwater Mining Company. These projects would become reasonably foreseeable in the view of the Forest Service if 1) Plans of Operations were filed, or 2) if Chrome market prices dramatically increased. These events are not anticipated to occur in the near future.
The reasons for not including these two properties is explained in the EA at the reference cited in the question. The size of their holdings does not indicate whether or not they will go into development/production, but rather the economic conditions of the commodities contained on their properties. Currently, economic conditions are not favorable for a new mining operation with these commodities, and future increases in chrome/ platinum/palladium prices are not anticipated.

7-24. Pg.59 Sect. 3.0(3): This paragraph indicates BHES will grant a waiver to the non-degradation policy. Absolutely no independent analysis is provided on the "costs" of the advanced treatment alternatives vis-a-vis the externalized costs to the environment.
Response: Independent analysis is not a requirement of MEPA or the Water Quality Act. Treatment costs are approximate. Environmental analysis of the alternatives as required under NEPA/MEPA and an analysis demonstrating that beneficial uses will not be adversely impacted are provided in the EA.

7-25. Pg.61 Sect.3.2.1: SMC percolation ponds are within 300' of Stillwater River, not 1/4 mile. The east adit is also closer than 1/4 mile.
Response: Most of the facilities are within one-half mile of the river. The east adit portal is one-quarter mile from the Stillwater River. The SVR percolation ponds are 600 feet from the River and the original percolation ponds near the east side adit are 300 feet from the River.

7-26. Pg.64 Sect.3.2.1: Surface water monitoring sites SMC10 (downstream) and SMC6 (close to Mountain View Creek by the administration building) are presently higher in nitrate concentrations than other monitoring points. Increasing production will put higher concentrations of nitrate directly into the Stillwater River.

Response: Increasing production will likely increase nitrate concentrations in the Stillwater River. The EA analyzes nitrate concentrations in Chapter 4.

7-27. Pg.67 Sect.3.2.2: Groundwater monitoring sites MW9 and MWII (downstream from mine water holding tank) are presently higher in nitrate concentration than other monitoring points. Increasing production will put higher concentrations of nitrate into groundwater. Nitrate levels were much lower prior to 1985 SMC mining operations.
Response: These monitoring wells, as wells as others, demonstrate elevated levels of nitrogen. Increasing production will likely increase nitrogen compounds in groundwater. Both the SMC petition and EA discuss this issue.

7-28. Pg.68 Sect.3.2.2: Lack of any monitoring wells in the vicinity of the drain field precludes an accurate assessment of off-site impacts to groundwater.
Only two samples at 1000 feet downstream have been taken for nitrate--one in 1989 and one in 1990. This is not adequate.
When adit discharge between March and May of 1991 was directed to Stillwater Valley Ranch percolation ponds and monitored, the nitrate levels went up significantly on M12A, M13A, and M15A (as per Table 3.2.4), located below the percolation ponds receiving adit water.
Response: Agency mitigation in Alternative 5 would require additional monitoring.
The chemical data, depth and location of this well indicates that it is primarily influenced by the Stillwater River and not groundwater flow from the mine. Alternative 5 would require additional monitoring.
The percolation ponds were designed to dispose of adit water which contains nitrate.

7-29. Pg.71 Sect.3.2.3: There was recently a 600 gpm interception of water which occurred during extension of the west side development. Interception of water bearing structure is expected to increase with increased development. Are they reported to agencies? Adjacent and/or affected landowners?
Response: SMC is required to monitor adit flows and report these values to the agencies. The agencies do not require adit flow to be reported to adjacent landowners. Agency permit files are open to the public.

7-30. Pg.78 Sect.3.4.2: Bighorn sheep mortality rate has doubled since SMC began operations. By 1982 average lamb crop was 10-11. From 1983 to 1988 lamb crop averaged 4. Since 1988 lamb crop has declined to 1.75 per year.
During the period of 1988 to the present, the Forest Service has closed the road to Woodbine, yet it's SMC's operations that have significantly impacted the Bighorn sheep. The public is unjustifiably bearing the costs of SMC's operations. These costs should be borne by SMC and not externalized to the public.
Response: Comments noted. Forest Service personnel have observed Bighorn Sheep use behind the barrier on FAS 419. The intent of the Area Restriction is to provide a high security area for these sheep. Provision of this high security area maybe contributing to the increased lamb recruitment observed during the winter of 1991-92.

The anticipated result of the mitigation measure contained in this document will lead to increased population recovery. Thus, the public would benefit in the long run by retaining an important component of the human environment.
The intent of closing the Woodbine road in the winter is to reduce the possible integration between the sheep and the public (see Chapter 3 discussion, Local Wildlife Species of Concern). Tourist traffic on the Woodbine road was also a portion of the traffic impact that led to the road closure.

7-31. Pg.83 Sect.3.6.2: The existing road closure program to Woodbine is not working and exemplifies an inadequate resolution to the Bighorn sheep problem. This program has not been successful and should be stopped.
Valley residents and recreationists are being penalized for impacts created by SMC. The costs created by SMC should not be externalized to the public. The sheep will obviously be additionally impacted by SMC 2000.
Response: See response to the above question 7-30.

7-32. Pg.83 Sect.3.6.3: Most of the current vehicles traversing the winter range on FAS 419 are related to SMC.
Response: SMC is not permitted to travel through the core winter range behind the barricade. The only vehicles which use FAS 419 south of the barricade are recreation special use permittees. This occurs infrequently. This mitigation measures resulted from the 1989 East Side EA/PER and the subsequent Decision Notice.
Winter mine traffic to the Beartooth Ranch is approximately 13 vehicles daily out of 25 vehicles. Mine traffic also uses an old road along the river, not FAS 419 or 400. See corrections in section 4.8.

7-33. Pg.85 Sect.3.7.1: The EA indicates CMR overlooks only part of the SMC site from a distance of 2-3 miles.
CMR is 1.5 miles from the proposed east side facilities and overlooks the entire SMC 2000 facility.
The document also indicates a limited number of points within CMR will be visually impacted by SMC 2000 facility. Most of the sites and all of the owners will see the facilities and be impacted in some manner.
All owners will view the facility from numerous points within CMR when driving to their homes or when hiking or horseback riding.
The east side buildings will also be visible from the highway when approaching CMR.
Response: Comments noted. The distance figure will be changed in the final document.
Some lots at CMR overlook primarily the East Side of the operation. The rock ridge which runs East to West on the West Side of the Stillwater River blocks most of the West Side operations. The notable exception is the upper elevations of the tailing impoundment.
Many of the lots at CMR (mostly at the northern end of the development) see little if any of the mine operations.
Additionally, the Stillwater Mining Company lies within Management Area "E" as indicated in the Custer National Forest Land and Resource Management Plan. The stated goal of this

management area is to "encourage and facilitate the exploration, development, and production of mineral resources. Other resources will be considered and impacts mitigated to the extent possible. Mineral development will not be precluded by these resource concerns within legal constraints" (pg 58 Management Plan).
Visual impacts are analyzed from common view locations, such as access roads and homes. These points are referred to in the 2 to 3 mile distance figures. Mitigation measures to reduce the short term visual effects are discussed in Chapter 2, Aesthetics, which will improve and speed up the long term VQO of Retention.

7-34. Pg.120 Sect.4.2.3: There are private homes and land between the SMC boundary and SMC 10 monitoring point below "SVR" ponds. They "qualitatively assume" that the nitrate concentrations will be diluted. Monitoring points must be required at various sites on the SMC boundary.
Response: There are no private residences on the east side between the SVR ponds and SMC-10 that are not wholly owned by SMC. This area does includes the Stillwater Valley Ranch which is owned by SMC. The water supply for the ranch is controlled by, and routinely monitored by SMC.

7-35. Pg.126 Sect.4.2.9: Nitrate concentrations are "highly variable" and would occasionally exceed 6.3 Mg/L in the groundwater. The EA indicates that dilution with groundwater and the Stillwater River are expected to diminish the concentrations. Will the dilution then take place after it reaches the Stillwater River?
Response: Dilution will initially occur as adit water mixes with groundwater and will continue in a downgradient (downstream) direction. As with most river systems, ground and surface water interaction is highly variable so that it is difficult to predict the exact nature of the mixing environment.

7-36. Pg.138 Sect. 4.3.4: Shawn Stewart's opinion on elk impacts is without substantiation. There has been one new cabin built since 1985 in the area of the elk winter habitat on CMR.
The number of winter residents on CMR has not changed from 1985 to 1991.
Mine related activities, however, have increased dramatically since 1985.
Response: A review of historic data provide by Stewart (personal communication, 1992) indicates that the entire CMR area comprised elk winter range. Since the onset of construction at CMR the area has been less utilized by elk, to the point that apparently no use currently takes place at CMR.
Although the elk have historically grazed on grass/forb in the vicinity of the mine complex, they do not use lands within the mine permit boundary. The elk issue was raised in Chapter 1, and dismissed through analysis, as this proposed expansion will not have additional impacts on the elk herd.

7-37. Pg.140 Sect.4.4.2: How can the EA reason that increased mine traffic will not impact the sheep? The EA - acknowledges that there will be more mine traffic but reasons that the

"impact threshold" has already been reached. The sheep would not be able to perceive any increase in traffic. Can this assertion be scientifically substantiated?
How does this "impact threshold" relate to the closure of Highway FAS 419 to Woodbine?
Response: Data provided by Stewart (personnel communications, 1992) indicates that traffic avoidance or acceptance patterns within the different portions of the herd have been established. Additional traffic within the mine area would not be expected to change these established patterns. Stewart's personal studies and observations of this specific herd over the last 15 years is the only scientific substantiation available to the decision makers. The establishment of the high security area behind the barricade relates to the traffic situation in that it provides an area where the traffic avoidance segment of the herd can eliminate traffic related stress or displacement.
Apparently the sheep which graze near the road have become accustomed to traffic (both SMC and tourist). An increase in traffic, as proposed, is not expected to additionally impact the sheep.

7-38. Pg. 140 Sect.4.4.2(4): CMR has continually been advised that the sheep have thrived and needed the nourishment of certain grasses on the Toe Dam, and now is informed that the elimination of this excellent pasture will not impact the sheep. How do the agencies reconcile these inconsistencies? How do the agencies deal with this significant impact?
Response: In the EA, section 4.4 indicates elimination of the tailing dam forage could spell the demise of the herd. This could happen if the forage situation changed quickly. No where in the analysis was it stated that "elimination of this excellent pasture will not impact the sheep". Bighorn Sheep Mitigation to be displayed in the final document is intended to 1) provide an alternative forage base of comparable nutrient quality and 2) minimize sheep displacement from the established forage base through tailing impoundment construction timing limitations. If the decision makers choose an alternative that will permanently eliminate the toe dike, certain mitigative measures available which could be incorporated to reduce and eliminate the resulting impact to the sheep, (see discussion in Chapter 4, Alternative 5).

Hydrometrics Inc. Letter #8
Helena, MT

8-1. p 8 Para 3) Expansion may not constitute an enlarged source of pollution as this paragraph states. Please see WQB letter of May 31, 1991 to Bruce Gilbert and Montana Water Quality Act 75-5-103 (5). Expansion would constitute an "enlarged source of pollutants. Pollution is defined in the Water Quality Act (WQA) as "contamination or alteration...or state waters which exceeds that permitted by Montana water quality standards..." As defined by Section 303(c) of the 1972 Federal Clean Water Act (33 U.S.C. 1313(c), a water quality standard is the designated beneficial uses of a water segment and the water quality criteria necessary to support those uses. As the EA shows, the expansion would not cause exceedance of numeric water quality standards and would not adversely affect beneficial uses. Moreover, "A discharge, seepage, drainage, infiltration or flow which is authorized under the pollution discharge permit rules of the board is not pollution under this

chapter (75-5-103 (5), WQA)". Discharge under SMC's current MPDES permit would not be considered pollution. Please also see paragraph 5, page 43.
Response: Use of the word pollution is justified and correct. The reference has been changed to ARM 16.20.702(1) which states that requirements of this subchapter apply to any activity of man which would cause a new or increased source of pollution. Otherwise, a permit would be issued that did not allow degradation. The important point to remember is that 'would' is used in a subjunctive sense and implies a future action. If production increased and a petition were not approved any degradation resulting from that action would be considered pollution. It is true that discharges authorized under rules adopted by the board do not constitute pollution.

8-2. p 48 para 1) Statement is made that "SMC would be required to.... validate the lower detection limits using the Method Detection Limit (40 CFR Part 136, Appendix IB)". Several points should be noted about Method Detection Limits (MDLs). MDLs are calculated based on laboratory performance on single element standards. These standards are essentially deionized water spikes and are free of the matrix interferences which commonly occur in natural water samples. MDLs calculated based on standards provide an estimate of the precision of the analytical method as performed by the laboratory under near ideal conditions. It is unlikely that laboratories can consistently achieve MDLs on natural water samples. This fact has resulted in the USEPA defining the concept of Practical Quantitation Limit (PQL). PQL is defined as "the lowest level that can be reliably achieved .... during routine laboratory operating conditions (50 CFR 46902, November 13, 1985)". PQLs are set at levels higher than MDLs and are usually estimated by the EPA to be 10 times the MDLs (see for example, 55 FR 30370).
Response: The EPA has proposed the use of practical quantitation limits (PQL) in the Drinking Water Programs for monitoring compliance with maximum contaminant levels (MCL). MCL are often 2 to 4 orders of magnitude greater than human health and/or aquatic life criteria. EPA does not recommend the use of PQL in the NPDES program since PQL are not analytically derived and, in some cases, may be arbitrarily set (EPA/505/2-90-001). MDL-based detection limits may be developed from either reagent blanks or actual sample matrices.

8-3. p 48 para 3) Statements that groundwater is not adequately monitored by the present system are not accurate. The present system detects changes in groundwater quality resulting from SMC operations and demonstrates that groundwater within the permit boundary is better than drinking water standards and meets the requirements of the prescribed beneficial uses. The present monitoring system is adequate in fulfilling its intended purposes. The present monitoring system would not be adequate if the petition is granted inasmuch as the compliance point would be at the property boundary. Additional wells would be necessary at the compliance point(s) to demonstrate compliance with the terms of the nondegradation waiver.
Response: SMC's monitoring plan states that "Operational monitoring is designed to provide early detection of any change in water quality in the hydrological system peripheral to and within the Stillwater Mining Company permit area resulting from the mining/milling

operation" (page 3, Water Resources Monitoring Plan, Stillwater Mining Company, January 30, 1986). According to this statement the current system of monitoring wells may not be adequate to achieve the stated goals. The text has been changed to reflect this uncertainty.

The present system adequately assesses the impacts of the SMC operation on ground water within the permit boundary. This monitoring has demonstrated that the drinking water standards have been maintained on and off the permit boundary. The concentration of certain mobile constituents, such as nitrate, as it leaves the property boundary, are not accurately known, other than they are assumed to be further diluted.

Additionally, since land application areas are not specifically delineated, the agencies must assume that this practice occurs throughout the SMC permit area. The EA states that land application is an effective treatment practice. However, the concentration of certain parameters may exceed the growth requirement the current vegetation. This condition represents a potential discharge that may have off-site impacts which are not monitored.

8-4. p 48 para 6) This paragraph is confusing and inaccurate. It is stated "If...ambient groundwater concentrations were being exceeded, SMC would be required to treat~ its discharge...'~. This would only be true if SMC were denied the petition. A more accurate statement would be "If permissible groundwater concentrations were being exceeded..". Moreover, there would be no legal requirement for SMC to treat its discharge as treatment is commonly defined (i.e. water treatment as defined in p. 175 of the DEA). It is possible that there could be options other than treatment which SMC could pursue to achieve permissible concentrations.

Response: Degradation only applies to new or increased sources of pollution [ARM 16.20.702(1)] outside of any applicable mixing zone. Under the current level of operation (1,000 TPD) increased concentrations outside the property boundary would be considered as off-site impacts or possibly violations, but not as degradation. Action would be required if permissible concentrations, including those allowed by the Board, were exceeded.

Stillwater Mining Company, Letter #9
Nye, MT

9-1. In the second paragraph of page 1, section 1.1, it is stated that "Approximately 75 percent of tailing created during the milling process is returned underground for use as backfill for mined out stopes. The remaining 33 percent is disposed of in a lined tailing impoundment...".

In the final document these statements should be changed to read "Approximately 65 percent...". and "The remaining 35 percent...".

Response: The second paragraph of the introduction (Section 1.1) contains erroneous information regarding the percentages of mill tailing segregated for backfill and disposal in the impoundment. The text should state that approximately 62 percent of the total milled tonnage is segregated for use as stope backfill, and 38 percent is deposited in the tailing impoundment.

Original metallurgical bench test studies indicate that 65 percent of the mill tailing could be used for sand-sized backfill. However, a finer mill grind required for optimum metallurgical recovery has caused an operational shortage of coarse tailing particles suitable for backfill. The backfill requirement is met by including waste rock in the ore feed to the mill. The resulting tail feed of 62 percent backfill and 38 percent ponded slimes has been relatively stabilized since the incorporation of waste rock for supplementation of backfill material (Amendment 005, 1989).
The text will be corrected to the proper percentages. For more detailed information on mill tailing deposition and use as backfill, readers are referred to pages 101 - 103 in Chapter IV.

9-2. On page 14, section 1.8.2, it is stated that "Increased mine activity in the vicinity of Woodbine campground, trailhead, and the Horseman Flats area may influence recreational use patterns." This statement referring to an increase in mine activity in those areas is misleading to the reader and should be stricken from the final document.
Response: See Section 1.9. This section was confusing to many readers and has been modified. The Issue and Issue Statements sections are not summaries of impacts. They do include summaries of issues which will be addressed in the EA. They do not function as analysis.

9-3. While this statement is, for the most part, true there is a small amount of mill process water contained in sandfill which, as it dewaters, becomes a part of adit water. This, the statement should be reworded in the final document.
Response: The text has been modified to reflect this fact.

9-4. The first sentence in paragraph 3, page 48, states that the groundwater north of the SMC permit boundary on the west side of the Stillwater River, is not adequately monitored by the present system of monitoring wells. This statement is inaccurate and misleading. The fact is, the current monitoring system is adequate to assess compliance with state and federal drinking water standards. However, additional monitoring may be needed in the future to show compliance with new ambient standards applicable to the nondegradation statute if SMC is granted permission to expand production.
Response: Please refer to the Hydrometrics letter, comment #3.

9-5. On page 48, paragraph 6, it is stated that if groundwater monitoring determined that ambient groundwater concentrations were being exceeded, SMC would be required to treat its discharge .... This statement does not recognize that other options aside from treatment may be available to SMC. The statement should be reworded to require SMC to show compliance with the ambient standards through treatment or demonstrate that compliance can be achieved through changes in operational practices.
Response: Please refer to the Hydrometrics letter, comment 8-4.

9-6. It is suggested that the data be re-reviewed and reinterpreted, with the topography of that area in mind. The area to the north and east is up hill, and against the bedrock outcrop constricting the valley north of the Stillwater Valley Ranch.

Response: No additional information has been submitted that would cause this statement to be re-evaluated. It is believed that groundwater flow follows approximately the same direction as the Stillwater River which, in this reach, is to the northeast. The chemical data from monitoring wells MW 12A, 131A, 14A, and 15A support this contention. Groundwater elevations increase in monitoring wells in this direction as the flow approaches the bedrock outcrop. The outcrop serves to constrict or funnel the alluvial groundwater system at this point and causes a significant, but unquantified, degree of mixing.

9-7. SMC requests that the reference to "50 feet or less" be stricken from the final text since a final plan has not been developed by SMC or approved by the agencies.
On page 50, procedures are outlined which are to be required at closure of the tailings impoundment or prior to final reclamation. The second of the last requirement deals with the inventory of alluvium or glacial till and requests soil replacement depths at levels which existed prior to mining. Please clarify intent.
Response: Soil loss calculations indicated that slope length needed to be reduced to 50 feet or less. DSL agrees that many soil erosion control practices can be implemented in the final plan to be approved by January 1, 1993. The final EA text will be changed to read "Soil loss calculations indicate slope length may need to be reduced to 50 feet or less."
The agencies would like soil replacement depths to approximate depths of the A and B horizons that existed in the area before mining began by SMC. The agencies realize that some soil was lost to preexisting disturbances. The agencies would like an evaluation made for each disturbance unit. SMC would list a soil depth based on the soil survey for the area. Then, they would propose a replacement soil depth, using soil stockpiled to date as A horizon material, and additional till or alluvium as B horizon material. The agencies expect that the soil replacement depth will have to account for losses due to past disturbances. For example, 12 inches may have been the depth of soil existing before mining began based on the soil survey. The available soil that can be salvaged may only equal 6 inches because of past disturbances in that particular disturbance unit. The new reclamation plan would place 3-4 inches of subsoil and then the 2-3 inches of soil that has been stockpiled to date. The agencies would interpret this as an attempt to reestablish soil replacement depths that approach levels that existed before mining.
The EA Text has been changed on page 50 to read " Address the amount of alluvium and/or glacial till needed as subsoil to increase replacement soil depths to levels that approach soil depths that existed in the area before mining. Consideration for preexisting disturbances will limit the amount of soil available for reclamation of some disturbance units."

9-8. Section 2.6.3 and the last requirement in section 2.6.2 on page 50 require plans for the testing of waste rock and tailings mass for acid generating potential over the life of the mine. SMC has provided the agencies with analysis which details the acid generating potential of waste rock and tailings material. The document needs to emphasized that the current method of beneficiation (Sulfide Floatation) removes sulfide material from the ore, hence the tailings sulfide concentrations are extremely low. Additionally, the ore has a buffering effect on the floatation circuit, SMC adds acid to the slurry to maintain a pH of

7.8 . The pH of the tailings normally runs around 8. The tailings impoundment is also lined and at final reclamation the deposits will be capped and sealed from the atmosphere. Over the past 20 years the ore zone and host rocks have been drilled and tested to support mining feasibility studies and claim patenting. Numerous reports and studies which were based upon this extensive drilling program have detailed the metal and sulfur content of the zone. Based upon these studies, the host rock has a sulfur content of .01% to .04% by weight. For reference, I have enclosed the results of three different studies. I believe it is obvious that the agencies have sufficient information and documentation to assure the public and themselves that there is no acid generating potential with this ore reserve and that an extensive waste rock and tailings characterization is unwarranted.
Response: The agencies agree that sampling to date has shown waste rock and tailings to be non-acid generating. The agencies disagree that an extensive program of verification sampling has been suggested. The agencies are asking for a waste rock and tailings analyses verification program over the life of the mine.

9-9. On page 86, section 3.8.1, it is stated that "The most recent Impact Plan Monitoring Data indicates that of the total 364 employees of the mine, 222 (61.0 percent) were classified as in-migrants and 142 (39.0 percent) as residents."
This is in error. The 1st quarter, 1991 Impact Report classifies 195, or 54 percent, of the total 364 employees as in-migrating, and 169, or 46 percent as residents. This error should be corrected here, and throughout the balance of the final document.
Response: The suggested changes have been made based upon the corrected March 31, 1991 Impact Report.

9-10. In the 3rd paragraph on page 94, SMC's Stratton Ranch facility is referred to as having a designed maximum of 32 mobile home - spaces, and it is stated that "SMC plans to phase out the facility over the next 3-5 years."
The Stratton Ranch facility's original design actually included more than 32 mobile home spaces, however only 32 were incorporated into the 1st phase of the facility. This facility underwent review and was permitted by the State as a subdivision development on privately owned land. As such, its existence is not connected to, and is not regulated by SMC's operating permit. Thus, reference to any SMC plans to phase out this facility should, and must, be stricken from the final Environmental Assessment Document.
Response: The narrative has been revised to indicate that the first phase of the facility had 32 mobile home spaces. It is recognized that the Stratton Ranch facility is not related to SMC's operating permit, but the information is pertinent to the analysis of the housing market and has, therefore, been included in the EA.

9-11. In the second paragraph on page 103, it is implied that less than 65 percent of the mill tailing is currently available for use as backfill, and more than the original 35 percent of the tailing is routed to the impoundment, thus reducing impoundment life correspondingly.
Response: The statement that less than the originally estimated 65 percent of mill tailing is suitable for backfill is correct. Similarly, more than 35 percent of tailing is deposited in the tailing pond. Although finer metallurgical grind contributes to the increased percentage of

impounded tailing, the increased percentage is primarily due to the milling of waste rock to supplement backfill requirements. At a waste rock supplement of 10 percent by weight (taken from application page 3-10, Table 3.2-3) and a 65 percent suitability of particle sizes as backfill, then the slimes production is:

{ (tons of ore) (.985) + (tons of ore) (.10) } .35

= 38 percent of ore tonnage, by weight, is impounded as tailing slimes. (Note: the factor .985 accounts for the 1½ percent of ore tonnage that is shipped as milled concentrate)

For additional information, please refer to the response to comment 9-1 of this letter.

9-12. In the first paragraph of page 113, it is stated that "A conservative estimate of 1,900 gpm may ultimately and permanently discharge as steady state groundwater flow into mine workings...". In the next paragraph, it is stated that "Surface water resources in the area will probably be impacted by the altered groundwater system."
Response: The groundwater flow into mine workings and subsequent steady state discharge is supplied by surface water resources. The relationship between surface water recharge and water-bearing structure intercepted by mine openings is explained in paragraph one on page 112. An increase in groundwater flow into mine openings is directly related to surface water resources being lost to groundwater recharge.

9-13. Throughout chapter 4 and 5 there are many references to the lack of soil salvaged to date and the need to expand soil salvage efforts to subsoil horizons. Although SMC does not disagree with these comments, they are used to lead the reader to the conclusion that the current reclamation plan and ongoing reclamation efforts are substandard and will result in reclamation failure. SMC does not believe that this conclusion can be reached on the basis of a soil loss equation alone. These references in the text should be restated in the positive to emphasize that final reclamation success can be enhanced through the addition of soil, subsoil, and soil substitutes.
Response: The agencies have stated that the current reclamation plan as being implemented will have marginal success because of limited soil salvage to date and limited soil replacement over waste rock. SMC has done a commendable job reclaiming disturbances to date with the limited soil resource and by irrigation and progressive fertilization programs. The agencies agree that final reclamation can be enhanced through the addition of soil, subsoil and soil substitutes. The agencies do not assume reclamation failure of the approved plan at all.

9-14. In the first paragraph on page 166 the agencies recognize that SMC has voluntarily instituted new soil salvage practices. However, nowhere in the analysis is their recognition of the fact that the company has voluntarily gone beyond the requirements of the existing reclamation plan and that reclamation success on the permit area typically exceeds agency standards. SMC believes that this fact should also be brought to the readers' attention.
Response: The agencies agree that SMC has voluntarily instituted new soil salvage practices. The agencies also agree that SMC has voluntarily gone beyond the requirements

of the existing reclamation plan and produced reclamation success that meets agencies standards for success. Now, the agencies need to insure that the soil salvage is completed and that the reclamation plan as permitted and bonded will meet agencies standards. The agencies cannot depend on voluntary commitments from the mining company in our reclamation plans. SMC has been instrumental in the use of organic fertilizers on their reclamation. SMC's work on reclamation innovation is appreciated. The agencies expect SMC to come in on January 1, 1993, with a progressive plan that will increase replacement soil depths and provide a basis for adequate bonding to ensure reclamation success without voluntary obligations.

9-15. In the first sentence on page 106, reference is made to the bulldozing of the tailings surface and the inference is made that the company's proposal calls for the dozing of the tailings to final contour and slope. The reference to dozing the tailings surface is meant to mean the grading and sloping which would occur after the addition of the waste rock cap prior to soil application.

Response: Page 4-6 of the amendment application submitted to the agencies states: "After the tailings have been sufficiently dewatered to support construction equipment, the tailings surface may be regraded as shown in Figures 4.2-1 (plan view) and 4.2-2 (cross section). Tailings will be bulldozed to prevent runoff over the embankment and to account for differential settling." On the same page, the application states that the "Grading of tailings or waste rock will be conducted so that a minimum one percent slope (post-settlement) away from the embankment will be achieved. The agencies agree with the discussion on page 4-9 of the amendment application regarding the questionable effectiveness of dewatering, and the probability that cap rock and stabilization fabric will be required for reclamation access and gradients.

9-16. In section 4.1.3d of the draft EA on page 110, it states that a borrow source would be required to complete the dam as proposed in alternative 3d. Our projections include a minimum development waste (excludes sandfill waste from the reef) to ore ratio of .41 to 1. Using this ratio, waste rock requirements for facilities construction, completion of the tailings impoundment and final reclamation cap and reclamation balance with projected available waste rock.

Response: The actual amount of waste rock that may be produced is unknown (see page 3-9 of the amendment application). The waste rock to ore ratio of .5 that is used in the environmental assessment is derived from the engineering analyses provided with the application materials, particularly Figure 9, Volume I of II, IECO report of February 1986; and Appendix A of Addendum B, Application for Amendment 008 to Operating Permit 00118, submitted December 1990.

The tailing impoundment alternative 3d, which considers increasing the embankment height while maintaining 2h:1v embankment slopes would have the following estimated distribution of waste rock:

- 2.3×10^6 yd^3 into dam (400,000 yd^3 more than the volume required for construction @ 1.6h:1v)
- 697,000 yd^3 (approx. 1.3 million tons) to supplement

sandfill

- 250,000 yd^3 for facilities construction
- 500,000 yd^3 for reclamation

Approximately 3.75 million cubic yards of waste rock may be required and 3.5 million cubic yards may be available. Therefore, a relatively insignificant borrow of 250,000 cubic yards of material may be required.

9-17. In section 4.5.2, page 145, paragraph 3, the reader is led to believe that the computer emissions modeling, which is a major component in the air quality analysis, is still forth coming from SMC. This paragraph should be changed to reflect the fact that the agencies received the emissions modeling with the submittal of SMC's air quality application.
Response: Text has been modified.

9-18. The last sentence in the fourth paragraph on page 167 should be changed to read, "The potential impacts and effects remain unchanged from those identified in the 1985 EIS".
Response: Comment noted.

9-19. In reference to the last paragraph on page 168, I offer the following comments. Some members of the general public tend to believe that shortening tailings impoundment life constitutes a significant impact since they assume that mining will continue as long as there is an ore reserve and that by approving a production increase you are knowingly pushing impacts into the future. These people tend to lose sight of the fact that metal prices and mining costs are the real measurement of mine life and that neither the agencies nor SMC have a crystal ball through which to gage these variables. In reality, a tailings impoundment is designed to store a specified amount of tailings and the life of the facility can be altered through changes in the ore grade, ore dilution, mill recovery, or any number of mining methods. These facts make the subject of mine and tailings impoundment life an operational decision not an environmental one. This paragraph presents the agencies an opportunity to address this issue.
Response: Comment noted.

9-20. In the third paragraph on page 171, the second sentence should be changed to read "...treatment or implementation of operational controls which would reduce degradation to approved ambient conditions.
Response: The text has been modified

Stillwater Mining Company Letter #10
James Richter, Environmental Specialist

10-1. In the fourth paragraph on page 126, it is stated that "Nitrates only become toxic under conditions in which they are, or may be, reduced to nitrite. Nitrite can be fatal to children under the age of 3 months due to the physiological susceptibility of this age group. High nitrates concentrations are common in domestic water supplies, particularly in rural areas resulting from improperly maintained domestic septic systems or agricultural practices."

These statements pose the following questions in the reader's mind:

A. What conditions may lead to the reduction of nitrates to nitrites, and do those conditions exist in SMC's water?

B. What is the current level of nitrites in SMC's water?

C. At what concentration, and ingestion rate can nitrites be fatal to children under the age of 3 months; and would nitrites in SMC's water ever be likely to reach that concentration level.?

D. How high of concentrations are common in the domestic water supplies mentioned, and do the conditions which may lead to reduction of nitrates to nitrites exist?

It is suggested that in the final document, either enough additional information be added to provide answers to the reader, or these statements be stricken.

Response: Nitrites are chemical intermediaries in a biological process known as denitrification. Bacteria common throughout the soil and water column utilize the denitrification process under anaerobic (without oxygen) conditions. Anaerobic conditions do not exist in the mine discharge but may be present down gradient of the mine.

The primary concern, however, is that in the digestive tract of children under six months of age the bacteria naturally present are capable of reducing nitrate to nitrite. This is a natural process that promotes the assimilation of nutrients. Therefore, it is immaterial what the actual nitrite concentration is but rather the concern is total (nitrite plus nitrate) concentration. As children grow the conditions in the digestive tract change and become unfavorable for this type of bacteria. The Maximum Contaminant Level (MCL) for nitrite plus nitrate is 10 mg/L and was developed to protect this age group.

Mineral Policy Center Letter #11
Bozeman, MT

11-1. It should also be noted that the EPA has yet to approve Montana's current water quality standards. This issue must be resolved before state level exemptions are contemplated.
Response: X-Ref to NPRC, Richard Parks Comments, Question #5.

11-2. Also Stillwater Mining Company's surface water discharge permit has expired and the company has failed to properly renew it as required by law. The Water Quality Board can not grant an exemption to a pollution source that does not have a valid discharge permit.
Response: SMC submitted a timely request for continuation of their MPDES permit, as required by ARM 16.20.1308. Although the expiration date on the permit has passed, the conditions of the permit remain until the BHES makes a determination on SMC's petition. The petition process is available to operators of pollution sources not subject to DHES permit requirements (ARM 16.20.704).

Suzanne Johnson Letter #12
Billings, MT

No new substantive comments

Stillwater Protective Association Letter #13
Jim Milligan, President

13-1. In our opinion, the EIS written for the mine needs to be consulted by the agencies when establishing a base line for significance.
Response: The original 1985 EIS has been liberally consulted, referenced, and tiered to in this EA.

13-2. The reclamation of the tailings dam and pond appear to be chancy at best because of a lack of sufficient soil. Soil needs must be determined and the available resources be inventoried as soon as possible. This is significant.
Response: The agencies have asked for a revised reclamation plan to be submitted by January 1, 1993. Sufficient soil material is still available to increase soil replacement depths to levels that approach soil depths that existed before the mining company began operations. Some reduction in replacement soil depths is necessary because of old historic disturbances in the area. The agencies feel that reclamation could be improved using new techniques. SMC has shown it can achieve reclamation success with limited soil resources and amendments such as irrigation and organic fertilizers, but it is expensive. Now, a revised plan must be submitted that reflects the true cost of reclaiming using limited soil and amendments such as irrigation, organic fertilizers, limited soil amendments, and/or additional soil resources. Reclamation is an important issue, but the agencies have no doubt that high quality reclamation will be the result of the changes in the reclamation plan.

13-3. The possible failure of the tailings dam with material behind it which can be liquified during an earthquake of fairly high magnitude in the next century or five should not be taken lightly. Also, this material contains chemicals with unknown toxicity and potential for damage to the water resources. Remember that the interaction of chemicals and/or biological agents over a period of time can change things for better or worse. This is significant.
Response: Complete liquefaction of the tailing mass was accounted for in the stability analyses by assuming zero shear strength for the ultimate impounded tailing volume.

13-4. We are in the position of being able to shape the appearance of the Stillwater river valley forever, or until the next ice age. We can specify and enforce a tailings impoundment design and a reclamation plan that will be so successful that succeeding generations will not notice that a major mine existed where SMC is now operating, or we can build an ugly monument to unwise development that these generations will abhor. This is a significant problem.
Response: The tailing impoundment location and visual impact was addressed in the 1985 EIS.

13-5. We favor the 2:1 slope for the face of the tailings dam with a mosaic pattern much like the rice fields in Japan. Also this design should be locked in with no possibility of SMC coming in with hat in hand in 10 years and requesting a change to 1.6:1 slope because the cost of

establishing another pond and dam will result in the loss of jobs and all of the other arguments for the gullible. This should be considered as a real possibility and a finding of significance made.

Response: If the agencies "locked in" proposals with "no possibility" of change, we would not be able to implement the mosaic pattern. The company has the legal right to request changes and the agencies must analyze the requests. The fact that tiering is part of the regulations means that the rules anticipated changes.

13-6. Another example; allowing the flow of water from the mine site in undiminished volume for all time is not smart. Applicable techniques exist which were developed at the Nevada Test Site for containing the products of the detonation of nuclear devices in a tunnel, or in short, stemming the tunnel. These techniques have been well developed by the DOE and should be available to the public. The establishment of the design criteria and implementation of such a plan is necessary and is significant.

If some mitigation measure like this is not included, the impact of all that water flow for all time and the implication of drying up current springs and aquifers is significant.

Response: Portal plugging to prevent mine water discharge is an optimistic concept that has not been successfully implemented in any known situation other than to route discharge from one portal to another. Current technology has yet to support the feasibility of portal plugging to eliminate mine water discharge. To the contrary, considerable literature and experience exists that demonstrates the large probability of portal plug failure. Although specifications concerning the Nevada Test Site (NTS) are not known, considerable differences are believed to exist between that application and the plugging of portals at SMC:

1. Underground workings at the NTS are accessed by vertical shafts, and are above any known groundwater elevations.
2. Drifts at the NTS are not affected by mining-induced stress field changes that underground mining development openings are; in general, mine development is only a fraction of the large volume of material that is extracted from the ore zone.
3. The adverse conditions being mitigated at the NTS are believed to be one time and temporary. The forces on portal plugs would be perpetual and constant. Portal plugs in mine openings leak and ultimately fail for a combination of reasons. Tectonic pressures cause stress field changes around excavations that are equilibrated and redistributed by fracturing. Destress fracturing and subsequent convergence, or the tendency of mine openings to close over time, occur extensively after the cessation of mining. Limitations to pumping grout further reduce the effectiveness of portal plugging. Portal plug failure is similar to the eventual failure of grouted inflows, which is discussed in some detail on the bottom of page 111 and the top of page 112.

The discharge of mine water is believed to approximate ambient water quality. A discharge of 1900 gpm from the bottom portals on the east and west sides would be easily carried in a flow of water 2 feet wide and 6 inches deep at a velocity of less than 2 feet per second. Portal plugging to prevent mine water discharge is not considered to be technically feasible,

and mine water quality and quantity is not expected to have adverse impacts on the environment.

13-7. We see no reason to not consider the impacts of additional mining efforts in the area. Just because the immediate future does not indicate a high probability for additional mine developments does not mean that this will not take place during the life of the SMC mine. Therefore, the impact of possible development must be seriously considered. This will prove to be significant.
Response: Due to the poor current and reasonably foreseeable economic conditions of the platinum/palladium and chrome markets, there are no grounds with which to predict any mining activities beyond the limited exploration currently being conducted (see Chapter 2, Projects of Concern Evaluated (CNF)). Should the economic conditions improve, any proposals by these companies will be dealt with in view of the SMC operations at that time.

13-8. Another impact which was not considered is the fact that a new mine is being developed on the East side of the Stillwater river. New infrastructure is proposed which is far above that described in the EA for this mine. Additional water pollution can come from the East side as well as the West side and brackets the Stillwater river. This is significant.
Response: The East side amendment authorized adits and facilities on the east side of the river. Impacts from development on both sides were thoroughly presented in this EA. This proposal is accurately summarized in the 20 pages of section 2.3. For additional details, the entire application is available for public review at the agencies offices.

13-9. p 3 para 5. Total disturbance is 163.6 + 35 = 192.6 acres.
Response: SMC has been continuously reclaiming disturbances so that total disturbance is not strictly additive.

13-10. p 12 para 1.8.1. All of the previously agreed upon mitigation measures for the impoundment are being changed for the worse and even a 2:1 slope is at risk in terms of reclamation and safety.
Response: Please see section 1.9 of the document. The section referred to in this comment was confusing to many readers who interpreted it as a summary of impacts, which it was not. That section summarized scoping concerns, not impact analysis.

13-11. p 25 The description of the East side facility certainly violates the earlier modification to the operating permit. Several findings of significance are possible here because of the appearance of a new mine where only one was present before.
Response: Because this section of the document is describing a proposal or request, there is no possibility of violation. A violation would occur if the company built these facilities without permission.

13-12. p 26 para 3. How much extra waste is the county expected to dispose of? The mine should be assessed a disposal fee over and above that of county residents which is related to the additional waste produced above that of a family.

Response: SMC is billed for solid waste disposal by volume and at commercial rates, the same as other businesses in the county.

13-13. p 27 para 2. The number of in-migrating employees necessary to bring the mine employment to 525 from the current 364 is 161, not 65. This is a significant change in the numbers of people which will impact the local economy and public facilities.
Response: The analysis of the socioeconomic impacts of the mine expansion was based upon the hiring of 161, not 65, additional workers. (See the first complete paragraph on page 152 of the Draft EA.)

13-14. p 28 para 1. What happens in the case of a "temporary closure"?
Response: Section 26.4.108, Abandonment or Completion of Operations, of Montana's Metal Mine Reclamation Act addresses the issue of temporary closures. That section states that the operation is presumed to be "abandoned or completed (and thus subject to the reclamation time schedules outlined in section 9 of the act) as soon as ore ceases to be extracted for future use or processing. Should the permittee wish to rebut said assumption, he must provide evidence satisfactory to the Board [delegated to the Commissioner of State Lands] that his operations have not in fact been abandoned or completed." Six situations including workers strikes or seasonality of operations are listed. The rules then state that at the discretion of the Board [Commissioner of State Lands] it may deem satisfactory:

evidence that valuable mineralization still exists;
continued employment of a maintenance crew;
or information on commodity prices, costs, etc., which may show that mining may soon resume on a profitable basis.

The permittee is required to provide maintenance on all environmental protective structures such as diversion ditches. Mines are required to perform temporary revegetation of disturbances like soil stockpiles. If water treatment were necessary, the mine would be required to perform that treatment during shutdown. Regular site inspections by agency personnel would occur which would ensure that environmental degradation did not occur. Should a problem be encountered, the company would be ordered to take immediate remedial action. If the company were unable to do so, the agencies would take emergency action. Agency actions of this type are paid for out of special funds such as the Fines, Fees and Penalties Fund.
The Final Reclamation Bond cannot be used for temporary shutdown. However, it would be sufficient to perform all final reclamation necessary at the particular stage of mine development, should the mine be determined "abandoned."
The Hard Rock Impact Act also addresses temporary shutdowns. Forty percent of the county's share of Metalliferous Mines tax monies collected under the HRIA are reserved for use when 50% or more of the work force is laid off. These funds are deposited in an interest bearing fund and can only be used by the local government to mitigate social impacts of layoffs or closures. Currently, approximately $400,000 is in this fund.

13-15. p 32 2.3.18.6. The originally anticipated volume of soil for reclamation has not been available and it is not likely to get any better. The suitability of substitutes is not assured.

Response: Agency review of the mine site in the fall of 1991 identified substantial soil materials are still available. Based on the plan submitted by SMC on January 1, 1993, the agencies will assess the need for additional borrow sources of alluvium and/or glacial till. Borrow materials may be needed to achieve replacement soil volumes that are considered representative of preexisting conditions at the mine site and that assure reclamation success.

13-16. p 37 para 3. After SMC's permit expires it appears that nobody is responsible for following the reclamation and maintenance of the mine sites. What is going on here? A significant problem is possible if this is so.
Response: The permit cannot "expire" until the agencies determine that final reclamation has been successfully implemented. The Metal Mine Reclamation Act provides for public input at that time. SMC, or should it be bought out, its successor, would be responsible through final reclamation. If certain facilities required perpetual maintenance, monies would be allocated in a trust fund, for example, to provide for that maintenance.

13-17. p 37 para 4. There should be a better outside estimate available for reclamation costs and there must be a provision for adjustment for inflation and the possibility of increased or decreased costs based on BACT as time goes on. A reevaluation is recommended every five years.
Response: The agencies will review SMC's estimated reclamation costs. DSL must approve reclamation plans using engineering estimates assuming the mining company walks off and leaves the property. If SMC's assumptions are inadequate, bonding levels will be increased accordingly. DSL's bond will include mobilization and administration costs of a plan performed by the state of Montana. Bond will be reevaluated at least every five years as required under MMRA.

13-18. p 49 para 2. Why was the emergency spill equipment not included in the East side amendment?
Response: This section refers to the procedures to be followed in case of pipe rupture. The East Side application included an emergency spill contingency plan which was deemed adequate and therefore, was not addressed in the EA. This paragraph changes reporting requirements.

13-19. p 51 para 1. Habitat improvement is based on doubtful reclamation potential. The SMC should be held responsible for actually coming up with a detailed plan and costs for returning the habitat to its original productivity.
Response: This EA addresses proposed changes to the currently approved Plan of Operation, not ways to adjust that current plan. Chapter 4, Proposed Action with Modification - Alternative 5, discusses the need for additional plans on SMC's part for habitat rehabilitation.

13-20. p 51 2.6.7. Recommend checking in June and July as most employees will carpool when the weather is bad and drive alone when it is nice.

Response: There is no evidence that allows predictions of employee carpooling in relation to weather conditions.

13-21. p 60 3.1.1. The subsidence of the surface into the old stopes and the hydrological communication of these subsidences with the mine itself is of concern. The possibility of long term pollution of this water and the quantity of water that can be involved in such flows is a question that must be answered. Also the communication of the stopes with the aquifers in the mountain could lead to pollution of the water in these aquifers. These are serious problems with a long term potential for damage to springs and other ground water sources and they must be identified and mitigation put in place.
Response: The actual location of stopes in the crown pillar (subject to subsidence and drawdown of surface water and shallow groundwater) are unknown, due to the variation in ore grade mineralization and a lack of definition drilling and stope delineation. Once the location of crown pillar stopes are known, however, it would be prudent to investigate the potential affected area on the surface for surface water resources that may be impacted. The surface area affected by mining in the crown pillar may not be large; if one third of the 6 mile strike length were mined to within 50 feet of the surface, the area affected by subsidence could approximate 12 acres. Mine planning that accounts for the proximity of crown pillar stopes to surface water resources could minimize potential impacts.

13-22. p 62 para 1. The upper Stillwater river basin does not have a high variation in average annual precipitation rate. The basin may have an annual total precipitation of so many inches at some measuring station, and this may vary from year to year by a factor of two. Now does that not make better sense?
Response: The statement that the upper Stillwater Basin has a high variation in average annual precipitation is not meant to imply that the area is unique in that regard. All similar mountain drainage exhibit variability in precipitation amounts with respect to elevation differences within the drainage, seasonal patterns, and annual patterns. The use of the term "high" to describe this variation is a subjective assessment of the situation.

13-23. p 71 para 4. The flocculent being used has ferric sulfite in it. This is going into the tailings ponds. Iron and sulfur in the presence of air and bacteria become ferric sulfate which is an acid and responsible for many of the cases of acid drainage from mines in Montana and other western states. Is this going to happen here? What is being done to insure that it does not happen?
Response: The document states that the flocculent contains ferric sulfate, not ferric sulfite. Sulfate is an oxidized form of sulfur and is not considered an acid-generating material.

13-24. p 87 para 3. After the mine layoffs in March the unemployment rate rose to close to 10%.
Response: The unemployment rate in March 1991 (i.e., 10.6 percent) is discussed in the second paragraph on page 88 of the Draft EA.

13-25. p 95 para 3. There are problems induced by the mine personnel in Stillwater County. When the number of mine employees increases to 525, an increase of workers by 161, the way

that these problems are solved will become very critical and will affect the quality of life for the residents. These solutions must be considered now and acceptable solutions identified and implemented.

Response: Employment levels of 460, which had been reached in 1990, are already considered under the Amended Hard Rock Impact Plan of 1989. Since employment levels had, one could assume that since the County Commissioners did not seek to renegotiate, that the plan was satisfactory and that local services are adequate. Of the 65 new employees, 35 would probably be in-migrating and 30 present residents.

13-26. p 104 The seepage of material through the liner would not be of much concern if it were just clean water. However, a large quantity of chemical materials are present in the tailings impoundment which have been accumulated over the life of the mine. An inventory of these materials and how they may in themselves be changed by chemical or biological interactions, their ability to leach out metals in the tailings materials, etc.. The degradation of the liner may be hastened by these processes resulting in liner failure over a large area and the dumping of this material into the ground water. This may or may not be a time bomb in the form of another superfund site. Through the use of independent, knowledgeable chemists and experiments we should be able to identify what may happen in the tailings pond when the mine shuts down and the remains molder away underground in the tailings pond over a period of centuries.

Response: The platinum group metals of the Stillwater complex are contained in the host rocks that have a relatively low degree of mineralization. After mining and crushing, nearly all of the low grade mineralization is removed as concentrate by froth flotation. It is worthwhile to note that SMC is the only flotation milling project that is known to utilize a lined tailing impoundment. All testing to date indicates that the tailing particles and tailing effluent are innocuous, and eventual deterioration of the liner is not expected to cause environmental degradation. Tailing impoundment water has been monitored since the mine started and has shown no synergistic chemical reactions such as discussed in the comment. Monitoring will continue throughout impoundment life. The reader is reminded that these tails are a fine-grained, clay-sized material which effectively inhibits fluid movement throughout the mass. At final reclamation, the tailing would be dewatered sufficiently to eliminate water from seeping out the bottom of the mass, even after the liner ultimately does fail. Proper reclamation of the surface gradient would direct precipitation off the tailing mass so that recharge would not occur.

13-27. p 108 All proposals seem to reduce the safety factor.

Response: The action proposed by SMC to steepen the downstream slope of the tailing impoundment embankment, would reduce the existing factor of safety against mass instability. The other alternatives that were analyzed would maintain safety factors equivalent to those of the existing facility. Please refer to Table 1.4.1, Tailing Impoundment Alternatives on page 42 of the EA.

13-28. p 111 4.2.1. The stemming proposed in the introduction would be a way to reduce the water flow from the tunnels.

Our version of the application of stemming plug use in this instance would consist of finding the fractured zone where the water is originating and then mining out the diameter of the tunnel on both sides of the zone. The increase in diameter is such that it will bear the design shock and pressure. Reinforcing steel is placed across the tunnel and this is designed for the same loads. Then forms for the faces of the stemming plugs are put in place, the space filled with concrete under pressure and allowed to set up under pressure. No voids are permitted by using a vent system in the top of the plug. In the case of SMC, we would also recommend filling the space between plugs with waste rock to reduce the sloughing of the tunnel into the void between plugs. In this way, the aquifer structure in the mountain can be reclaimed. This is a significant design problem and can not be ignored.
Response: Please refer to the response to Comment 6-13 (Milligan). Please give reference, report or mine location where this system has been used with success.

13-29. The main worry is the interaction of the water percolating through the stopes from the surface with the materials in the stopes, as noted earlier, which would not necessarily be controlled by the stemming. A study of how to prevent this from happening is needed.
Response: Interception of groundwater or surface water resources by mine openings is an inevitable consequence of mining the Stillwater deposit. It is not known how much water will be intercepted and percolated through backfilled stopes, but adverse effects on water quality are not anticipated.

13-30. p 114 para 3. What is a minimal amount of sediment?
Response: Due to the sediment control structures already in place, there will be no increase in sediment from the proposed expansion.

13-31. p 115 para 2. If a leak is detected in one of the welds, what do you do? There is a degradation of ground water if a leak is detected. Get a procedure established for containing, stopping or admit that the law was broken and get out of town.
Response: Major leaks from impounded tailing are generally partially contained by downgradient pumpback systems. It is not believed that a major leak could occur in the Stillwater impoundment, due to the low permeability of the tailing mass above a liner defect. Please refer to the discussion on pages 104 and 105 concerning tailing effluent seepage through liner defects.

13-32. p 130 para 4. Lead is a material that is being blamed for a number of problems in children. As we become more knowledgeable about various pollutants it may be that similar long term effects will be discovered for the pollutants listed here. It is not enough to say that current standards are adequate. It is enough to say that current water quality will not be changed in either the ground or surface water.
Response: The lead concentration of the adit water is well below the MCL (0.050 mg/L) and the proposed level of 0.015 mg/L. EPA has proposed lowering the MCL based on information that children absorb more lead than adults when exposed. The concentration of lead in surface and groundwater should not increase above existing levels.

13-33. p 131 para 2. Separate the water streams in the tunnels so aquifer water that is clean is not mixed with the water coming from the stopes or blasting areas. This will make treatment cheaper and easier because of reduced volume of water to be treated.
Response: It is not reasonable or practical to attempt to intercept groundwater. The net flow of mine water is comprised of a myriad of discharges from fractures and drill holes. Mine water drains by gravity from upper levels to lower levels, and discharges by flow in ditches at the floor of the drift. The present systems for handling mine water discharge are adequate.

13-34. p 136 The question of revegetation of the dam face should not be in doubt. A 2:1 slope and a mosaic treatment to retain the soil until the grasses take hold makes a lot of sense and is recommended here. The main question is what is the source of the soil? Will this mean another reclamation project in another area? How is this to be managed?
Response: See comments 13-5 and 13-21 about soil availability and the potential need to borrow soil materials.

13-35. p 140 para 4. Do not reduce the number of employees per vehicle. Three is not enough in our opinion. The use of mandatory bussing as on many test sites is our choice. This will also reduce the road kill of wildlife.
Response: The number of employees per vehicle has not been reduced; it remains at 3. For traffic discussions, please see section 4.8.4.

13-36. p 141 para 2. As stated before, the saturated material in the impoundment has very little shear strengths and under attack will certainly liquify. What are the exact implications of such a failure? We need to know so in case it happens there is a plan in place for dealing with it.
Response: Please refer to the response to Comments 4-4, 4-5 and 13-3.

13-37. p 145 para 4. Having studied computer modeling of air pollution problems, it is apparent that there is no model which will handle the Stillwater valley. Why is it even being done? A series of measurements using realistic conditions and sources is probably the only way to get close to an answer.
Response: Refer to the response to Comment 4-8. In addition, ambient air quality monitoring has been done around the SMC operation since its beginning. Results indicate only a minimal impact to air quality. Based on that assessment, the increase in impacts associated with this proposal should also be minimal.

13-38. p 146 Table 4.5-1 should include the emissions from the employees cars and trucks as well as the large trucks that carry supplies to the mine and concentrate from the mine to the smelter.
Response: These types of emissions are referred to as secondary emissions and are not typically included in the emission inventory for a project, mainly because the majority of these emissions occur off-site. The secondary emissions which occur on-site are included in the analysis.

13-39. p 147 para 5. The lack of housing for an additional 161 families certainly looks like a very significant impact on the county, contrary to the statement in the EA.
Response: The analysis on page 147 refers to the effects of the mine expansion on land uses; the impacts on the housing market are discussed on page 154 of the Draft EA. Also, as indicated on page 154, the number of households in Stillwater County is expected to increase by 50, not 161.

13-40. p 152 para 1. The number of additional employees is here stated as 161. There is one other observation, the mining effort on the East Boulder is stated to require 600 employees. How can SMC on the Stillwater get by with 525 employees to produce 2000 tpd when the same output on the Boulder requires 600 people. Can we expect to see another amendment in the near future to increase the mine force to 600 which is an increase of less than the 15% necessary to trigger the Hard Rock Impact Act?
Response: Although the two mines are very similar there are differences, such as the 3.5 mile adit required at East Boulder. When total employment rises 15% above the 460 level or to approximately 530, the plan will be automatically opened for renegotiation. SMC cannot avoid renegotiation by proposing a succession of 14% increases.

13-41. p 148 para 3. The 161 employees that the mine needs are not available locally. SMC projects half of these people will come from here. Look at the unemployment figures and that is just not possible, plus the fact the mine needs miners which do not grow on farms.
Response: The most recent published labor force statistics indicate that the unemployment rate in Stillwater County in September 1991 was 7.8 percent with 221 persons unemployed. In the month before the Stillwater Mining Company reduced its workforce (i.e., in February 1991), the unemployment rate was 5.5 percent and the number of unemployed was 181. Although some of those who were laid off have undoubtedly moved, it is likely that many remain in the area. Also, some of the laid off workers who have stayed in Stillwater County probably are not showing up in the unemployment figures, since they are no longer actively seeking work and, thus, do not meet the definition of unemployed. These "discouraged workers" may, however, reenter the labor force if suitable employment opportunities arise. Other local residents may also enter the labor force to apply for available, relatively high-paying jobs. It is true, of course, that not all of the 221 unemployed possess the experience, skill, or interest to work at the mine, but, as explained above, those currently counted as unemployed do not constitute the only potential source of local workers. The basis for the estimate of the number of inmigrating workers is discussed in the population section of Chapter 4 of the Draft EA (page 153).

13-42. p 148 para 5. The statement that recreational facilities are available in the Stillwater valley to accommodate all of the miners, families and additional folks from Billings and elsewhere is ludicrous. That is an additional 525*3=1575 people that are looking for a place to recreate. They must go elsewhere and/or overload existing areas thus causing potential irreversible abuse to the areas.

Response: Current recreational use trends appear to be declining (Chapter 3, 3.6.1 and 3.6.2). The increase in employment by this proposal is 161, not 525, and only 35 of these new employees are expected from outside Stillwater County (see Chapter 4, Population).

13-43. p 156 para 3. DSL must enforce the traffic mitigation requirement of at least 3 persons per vehicle for the employees of the mine. Altering mitigation measures sets a bad precedent, in any case.
Response: Mitigation is designed to alleviate impacts and should be changed based upon monitoring of the impacts and effectiveness of the mitigations. 3.0 persons per vehicle has not been changed, but employees living within 10 miles of the mine would be exempt under alternative 5.

13-44. p 158 para 3. Monitoring should take place during the summer, also. This is when the maximum traffic flow occurs when tourists and visitors to Woodbine drive the road. The opportunity for accidents is highest then so mine vehicular traffic should be limited to a minimum. Also, the large trucks and multi-axle trailers have been left out of the analysis. Put them back in, as they have a pronounced effect on traffic.
Response: See response 13-35. There is an anticipated commercial truck increase of five per day associated with this proposed expansion.

Mary Donohoe, Letter #14
Nye, MT

14-1. The highway which continues to deteriorate badly is still a serious problem and a serious consideration.
Response: Road construction is continuing with replacement of bridge at Fishtail and near the junction of FAS 419 and FAP 78. In the Hard Rock Impact Plan, SMC has committed $1.4 million in road construction funds.

James Phelps, Letter #15
Billings, MT

No additional substantive comments.

Jean & Patrick Rollwitz, Letter #16
Billings, MT

16-1. Mine waste water should not be allowed to be discharged directly into the Stillwater River! The Stillwater River is too valuable an asset to the area to take a chance on polluting it ! Is it possible the sprinkling they do from the settling ponds does not already pollute the river? Does this need further checking into?
Response: Dischargers, such as SMC, must comply with all water quality standards. SMC has been issued a discharge permit which is discussed in the document.

16-2. We have a place within sight and sound of the mine and are affected directly by anything they do. We have water rights on the National Forest next to us. This water comes from a spring. Between us and the mine there were four springs which have dried up. Naturally we are worried about losing the quality and quantity of our water supply !
Response: The agencies have not been notified of these springs being effected. Under state law, if the mine has impacted springs, SMC would be required to replace that water. Please furnish the agencies with information so that an investigation can begin to resolve this problem.

George & Lucille Moses, Letter #17
Nye, MT

No additional substantive comments.

US Environmental Protection Agency, Letter #18
Helena, MT

18-1. Were there any reasons that the public meeting could not have been held in early January?
Response: The Montana Environmental Policy Act states that a hearing to gather public comments must be held within 20 days of release of a draft environmental document. The 2000 TPD draft was mailed on December 10 and 11, which makes the 20th day December 30. The National Environmental Policy Act does not have provisions for public hearings on EA's.

18-2. The EPA can not assume that selection of the Forest Service preferred alternatives will prevail as the ones actually utilized.
Response: That is correct. NEPA does not require the decision maker to choose the preferred alternative, which is why the decision document includes the rationale and reasons for making the decision.

18-3. The Forest Service proposed actions with modification Alternative 5 states that several plans will be developed regarding impacts (water resources monitoring plan, reclamation plan, and waste rock plan). The EPA asks what do these plans incorporate? Will these plans reduce or eliminate significant impacts and how?
Response: Monitoring plans do not mitigate impacts. Under 40 CFR 1505.3, monitoring may be used by the agencies to assure that decisions are carried out. Monitoring plans attempt to verify analyses of impacts and their severity. A supplemental plan of action or supplemental "mitigation" can be developed if needed. Monitoring plans can and should be revised by the agencies when the gathered information warrants. Updating the reclamation plan was included in this EA as a matter of informing the public of changes in reclamation. Reclamation plans are constantly improved as test results and new technologies are developed. Much of the Alternative 5 modification to the reclamation plan has already been adopted by SMC and incorporated into its plan. Should the No-Action Alternative be

selected, the remaining modifications to the Reclamation Plan will still be implemented under the authority of the Metal Mine Reclamation Act.

18-4. What specific activities and expansions will take place on federal land?
Response: These acreages are for the Company's proposal only.

FOREST SERVICE		PRIVATE	
PROPOSED RELOCATED WEST SIDE		Guard Shack	.18 AC
		Warehouse/Truck Stop	.72 AC
		Warehouse/Truck Stop	.54 AC
PROPOSED/NEW/WEST SIDE			
Temporary Waste Storage/ Laydown Area	3.78 AC	Laydown Area	2.51 AC
Laydown/Temporary Waste Rock Storage	2.07 AC	Laydown/Temporary Waste Rock Storage	0.63 AC
Conveyor Stocker	0.09 AC	Conveyor Stocker	0.63 AC
Mill Building Ext.	0.27 AC	Mill Building Ext.	0.09 AC
Parking Lot Ext.	0.09 AC	Drainfield Ext.	0.54 AC
Laydown/Permanent Waste Rock Storage	8.64 AC	Parking Lot Ext.	0.18 AC
		Tailing Impound.	4.00 AC
RELOCATED/EAST SIDE			
Permanent Waste Rock Berm	6.03 AC	Permanent Waste Rock Berm	6.48 AC
		Laydown Area	1.08 AC
		Building	0.45 AC
		Parking	0.09 AC
		Drainfield	0.54 AC
TOTAL	20.97 AC		18.49 AC

18-5. The EA states, "SMC's present bond is $1,477,000" (page 6), does this amount include the proposed expansion? Were previous amendments covered by bonding?
Response: The immediately preceding paragraph on page 6 explains how bonds are set and what they include. The $1,477,000 is the "present" bond on the existing reclamation plan. By law, bonding of previous amendments has been included in the present amount. The original bond has been increased on four occasions. The bond will be adjusted to reflect any approved alterations in the plan. The bond must also be in place prior to acting on any approvals they might receive. Specific bond calculations are complicated and lengthy. It is a wasteful task to try to pre-calculate a bond since the plan is only finalized in the decision document. Bonding calculations are open to public review at any time and the agencies routinely respond to concerns about such calculations.

18-6. How well did the initial EIS attempt to forecast and discuss the cumulative impacts of the mine expansion as approved in amendments following the preparation of that EIS?
Response: The original EIS has been quite good at predicting impacts, and in most cases, has over predicted. Please see each resource discussed for specifics. Agencies reviewed all subsequent amendments to ensure that the effect was within the scope of the original EIS.

18-7. Does this EA attempt to forecast and discuss possible future mine expansion(s) in a cumulative manner?
Response: Cumulative effects must, by law, be considered in an EA or EIS. MEPA allows only proposals which are currently under review. NEPA directs that cumulative effects must be reasonably foreseeable. It is the more stringent standard (i.e., the NEPA standard in this case) which is applied in a joint document. At this time the agencies are unaware of the company's future expansion plans. However, the potential for expansion is discussed in Section 2.7.3. In a number of cases the courts have indicated it is appropriate to segment projects (County of Suffolk v Sec. of the Interior) when a later stage is not yet approved and a causal relationship is not shown. Any approval or approval with modification pursuant to the Stillwater proposal will not be applicable to any future proposed disturbance. Further, approval of this plan or plan with modifications would not cause a future stage of the project to be approved. Therefore, the need for analysis of any speculative number of future tailing impoundments based on the assumption of market stability is limited. As indicated in Section 2.7.3, when and if a proposal for a second tailing impoundment is received, it will be evaluated under MEPA/NEPA and other applicable statutes. Thus, full public involvement and disclosure is assured.

18-8. The EPA requests that the Forest Service prepare a Finding of No Significant Impact (FONSI) or complete an Environmental Impact Statement (EIS).
Response: The agencies must by law either prepare a FONSI or complete an EIS.

Beth Deegan, Letter #19
McLeod, MT

No additional substantive comments.

Joseph Kelly, Letter #20

No additional substantive comments.

Magic City Fly Fishers Letter #21
Richard Hibinl?, President

No additional substantive comments.

22-1. For example, "mixing zones" which will obviously violate standards are seemingly excused by rationalizing that SMC controls private land on either side of the river in these zones. This ignores the concept that water resources are public domain even when bordered by private land.
Response: Mixing zones are defined for both surface [ARM 16.20.603(1) (2)] and ground [ARM 16.20.1001(6)] water. Mixing zones are granted based on the premise that present and anticipated beneficial uses will not be impacted.

22-2. Aquatic insects, which are essentially non-migratory, will be exposed in these mixing zones to excessive levels of heavy metals, which can then be expected to move up the food chain. I have been told by a FW & P biologist that this stretch of river between Nye and the mine is the most important spawning area of the entire river. Fish hatched here are generally thought to remain in this stretch until they are 4-6 inches in length, before beginning migrations of their own. What effects will there be on these small fish which live and feed in this localized, altered environment? The EA is inadequate in this analysis and I believe that an EIS is appropriate.
Response: Aquatic insects are generally found in surface water, such as the Stillwater River. SMC discharges to groundwater via percolation ponds or land application, therefore, aquatic insects will not be directly affected. Freshwater chronic criteria discussed in Section 4.2.2 were developed to account for bioconcentration or accumulation of metal in the food chain. These criteria will not be exceeded.

22-3. The entire argument for exemption from water quality laws seems to pivot on the unproven premise that SMC cannot economically expand and protect the public water resources. The EA seemed completely inadequate in its investigation and documentation of the economic aspects of the situation. Only three pages were devoted to discussion of advanced water treatment options, with essentially no discussion of economics.
Response: The commenter has drawn his own conclusions regarding the economic feasibility of the treatment options. The agencies have stated that any change in ambient water quality and subsequent level of treatment will be determined by the BHES. The section on water treatment has been expanded and additional updated costs provided.

22-4. The EA fails to adequately address the cost/benefit considerations such as:
(1) A detailed statement of economic and social need for proposed expansion.
(2) An analysis showing that the public would be better off with the expansion and lower quality water.
(3) A detailed analysis of anticipated future development in the area with explanations as to why maintenance of existing water quality is no longer of optimism benefit to the public. For example, will the proposed degradation of water by SMC preclude future developments in the region such as the proposed chrome mine or will the quality of the water be such that other future projects be limited in any way when cumulative impacts are considered?

4) The EA also failed to adequately address the impacts of lowered water quality or present and future beneficial uses of the water resources. The image of the Stillwater River as a pristine water resource is essential to the county In attracting new residents, businesses, tourist and recreation. The health of the Stillwater River must be preserved in order to exert such an influence in the future.

Response: Items (1) through (3) may be required, as warranted, in a petition submitted to the DHES (ARM 16.20.704). The EA/EIS analyzes the environmental impacts of the proposed action. Material submitted in the petition and presented to the BHES at the public hearing on the petition, will determine the economic and social need of the project. The agencies' analysis does conclude that beneficial uses will not be impaired if the petition were approved at the levels analyzed in the document.

Stillwater Protective Association, Letter #23
Jim Milligan, President

No additional substantive comments.

Bear Creek Council, Letter #24
David Price, President

No additional substantive comments.

Randall Dinger, Letter #25
Billings, MT

No additional substantive comments.

Montana Wildlife Federation, Letter #26
Kathy Hadley, Rich Day, Ron Cooper

26-1. The assessment recognizes this loss in water quality, but fails to consider its ramifications. The assessment concludes that, "... percolation from the ponds (after clarification) at the mine would result in changes in the quality of ambient groundwater in the vicinity of the ponds and in the surface water in the Stillwater River." The proposal then indicates that "... an increase in chemical load (mass of a chemical compound or element in water) of nitrogen compounds and metals discharged to groundwater or surface water may increase and therefore requests a change in the water quality limits for groundwater, and for surface water in the Stillwater River to concentrations higher than the ambient conditions."

Response: Section 4.2.2 analyzes the impacts to surface and groundwater quality.

26-2. The assessment has a number of deficiencies. It fails to adequately consider ways to mitigate impacts to the Stillwater River, instead relying upon the lowering of water quality standards to allow the project to move forward.

Response: The analysis presents two alternatives which maintain existing water quality, that is, Alternatives 4a (no action) and 4c (advanced water treatment). The petition is included in the company's proposal, Alternative 4b.

26-3. It identifies a hydrologic connection between the waste disposal ponds and the Stillwater River, but fails to regulate that connection as a point source and to require a Montana Pollution Elimination Discharge System (MPDES) permit.
Response: SMC has an MPDES discharge permit; however, the company's current method of discharge is not classified as a point source discharge [ARM 16.20.1304(41)] and is therefore more appropriately regulated under the groundwater rules (ARM 16.20.1001).

26-4. There is no attempt to consider non-point pollution.
Response: Section 4.2.2 addresses runoff and sediment control.

26-5. Under the department's regulations concerning the need to prepare an environmental impact statement, the granting of a waiver of the state's non degradation policy would constitute a major action making irreversible commitments to resources with both long-term and short-term impacts. It necessitates the completion of an environmental impact statement.
Response: An EIS is required if the impacts of a project may be significant. Many projects which do not require a nondegradation petition have significant impacts. Conversely, the granting of a petition does not de facto mean that the environmental impacts would be significant.

26-6. There is little or no attempt to consider specific site factors, investigate innovative means to control both point and non-point pollution, mitigate impacts, or identify site specific costs and benefits to hydrologically connected ground or surface water in the Stillwater River.
Response: Nonpoint source pollution has been addressed in section 4.2.2 and alternatives have been developed that would maintain existing surface and groundwater quality.

26-7. The consideration of a non-degradation waiver places an affirmative responsibility on the applicant to show the granting of a waiver is necessary. The applicant in the assessment fails to make this showing.
Response: The environmental assessment is prepared by the agencies, not the applicant. It is the applicant's responsibility to demonstrate to the BHES the economic and social need of the project.

26-8. Based upon a demonstration of need, the Board of Health is required to make a determination that a change in the non-degradation policy is justifiable. There is insufficient data in the assessment for the Board to make a decision.
Response: The nondegradation policy grants authority to the BHES to allow degradation after certain conditions are met. The BHES will decide if sufficient information has been presented.

26-9. The assessment considers the waste disposal ponds exempt from both surface and groundwater permit requirements.

26-10. The assessment fails to consider a Montana Pollution Discharge Elimination System permit even though a hydrologic connection between the waste disposal pond and the Stillwater River is recognized. Both federal regulation and a number of court decisions have concluded that discrete conveyances hydrologically connected to surface waters are point sources subject to the federal pollution elimination discharge permit system.

26-11. EPA intends to embrace the broadest possible definition of point source consistent with the legislative intent of the CWA and court interpretation to include any identifiable conveyance from which pollutants might enter the waters of the United States. In most court cases interpreting the term "point source", the term has been interpreted broadly. For example, the holding in Sierra Club v. Abston Construction Co., Inc., 620 F.2d 41 (5th Cir. 1980) indicates that changing the surface of land or establishing grading patterns on land will result in a point source where the runoff from the site is ultimately discharged to waters of the United States.

{T{his rulemaking only addresses discharges to waters of the United States, consequently discharges to ground waters are not covered by this rulemaking (unless there is a hydrological connection between the ground water and a nearby surface water body.) {Emphasis added} See e.g., Exxon Corp. v. Train. 554 F. 2d. 1310, 1312, n.1 (5th Cir. 1977); McClellan Ecological Seepage Situation v. Weinberger, 707 F. Supp. 1182, 1195-96 (E.D. Cal 1988)) .{7}

Response to above 3 questions: Discharges to state waters are regulated under the Montana Clean Water Act (75-5-401, MCA) which, unlike the federal Clean Water Act, regulates both surface and groundwater discharges. Montana has developed a permit system for both classes of water. In other jurisdictions, it may be necessary to regulate groundwater discharges through the NPDES program if a hydrologic connection has been established.

Mining operations, as well as certain other activities, are excluded from the Groundwater Pollution Control System (GWPCS) permit requirements [ARM 16.20.1012(1)(m)], but are required to comply with all water quality standards. No such exclusions are available to point source discharges, as defined under ARM 16.20.1304.

The environmental assessment analyzes and discloses impacts to beneficial uses in both surface and groundwater. And, discusses the process under which the nondegradation decision is made by the BHES.

26-12. A precondition to the consideration of a waiver is the use of "best available technology". 40 CFR. Section 131.12 (a) (2) states, in pertinent part: ...

The anti-degradation policy [of a state] and the implementation methods shall, at a minimum, be consistent with the following:

[T]he State shall assure that there shall be achieved the highest statutory and regulatory requirements for all new and existing point sources ...

The assessment, by failing to consider established policy, fails to achieve the disclosure necessary to base a rational decision.

Response: Sections 2.5 and 4.2.2 discuss state and federal treatment standards including best available technologies (BAT).

26-13. The Montana Constitution provides both an individual right and directs the state to protect this right. The Constitution requires the state to maintain and improve a clean and healthful environment in Montana for present and future generations.
Response: The agencies believe that the present reclamation plan provides for a clean and healthful environment. However, because of the advancement of reclamation practices and technologies since the original plan was developed, the agencies have asked that a revised reclamation plan be submitted by January 1, 1993. Sufficient soil material is still available to increase soil replacement depths to levels that approach soil depths that existed before SMC began operations. Some reduction in replacement soil depths is necessary because of old historic disturbances in the area. SMC has shown it can reclaim with limited soil resources and amendments such as irrigation and organic fertilizers and meet the new reclamation success criteria. The revised plan will reflect the true costs of SMC's efforts. The agencies feel the issue of reclamation success is ongoing and will continue to review reclamation activities until final reclamation is completed.

26-14. The assessment needs to consider any long-term impacts associated with this increase in metals to both ground and surface water and the potential for any bio-accumulation of these substances. Consideration then needs to made of ways to mitigate these impacts and to avoid natural resource damages.
Response: See the comment response 22-2.

Bear Creek Council, Letter #27
Jeanne Peterman, Vice President

No additional substantive comments.

Greater Yellowstone Coalition, Letter #28
Bozeman, MT

28-1. Yet the only alternative presented in this EA for disposing of additional tailings is the company's current proposal to expand the existing impoundment.
Response: Alternative 3d was developed by the agencies to increase impoundment capacity while maintaining the 2h:1v slope. See section 4.1.3d for discussion of the impacts of this alternative.

28-2. The EA, unfortunately, failed to adequately discuss what the employee concerns were with this mitigation measure; why the two changes for the 10 mile exemption and twice-yearly reporting periods are being supported by the agencies; and what other alternatives exist for addressing these concerns... In addition, the agencies also need to provide data to show how the 10 mile exemption will affect traffic. While the EA shows traffic projections under the company's proposal, it does not show projections for the agencies' alternative.

Response: Text has been modified to include this discussion.

28-3. Finally, the agencies need to discuss the rationale for changing to twice-yearly reporting, and why the two months of March and September were chosen. There is not enough information to understand whether the change will ensure adequate monitoring of this mitigation measure, and give a true measure of year-round compliance.
Response: March and September were chosen because they were months with low occupancy rates and were 6 months apart. The mitigation calls for annual average compliance, not constant compliance.

28-4. We are concerned about a few issues addressed in the EA that indicate problems with existing monitoring or mitigation measures, particularly because it is not clear whether or how these issues would have been addressed in the absence of this proposal. In the EA, the agencies acknowledge that groundwater to the north and northeast of the SMC property boundary is not adequately monitored to accurately assess off-site impacts. Yet in the last monitoring report we received, dated March, 1991, there is no indication of inadequate monitoring. Why not? In the absence of this information, how can the agencies make legitimate decisions about water quality impacts as a result of this proposal?
Response: Monitoring reports are prepared by SMC and reviewed by the agencies. The current monitoring program may not be adequate to assess any water quality degradation that may result if the expansion is approved, therefore, additional monitoring would be required.

28-5. Similarly, the agencies note that the presently approved reclamation plan is not likely to be successful, and should be reevaluated. The problem is apparently related to soil salvage difficulties, erosion and soil losses. Yet the same monitoring report referred to above states that SMC salvage actions to date have resulted in 'generally excellent reclamation and revegetation of disturbed areas.' No reference is made to soil salvage difficulties, erosion or soil losses.
Response: SMC's reclamation success with limited salvage has been possible by supplementing limited soils by irrigation and organic fertilization and has produced excellent results. This is not the approved reclamation plan and these supplemental commitments are not bonded. The agencies review has identified the need to increase soil salvage requirements and bonding and/or bond for the additional commitments needed to produce the reclamation success needed.

28-6. The EA notes that the bighorn sheep herd has declined significantly from 60 animals in 1977-78 to 24 animals in 1990-91, and is thought to be, at least in part, the result of increased human activity on the winter ranges, and overgrazing of the winter range by domestic cattle and horses. The agencies also note that there is considerable evidence that the black bear population on the entire Beartooth face is declining, primarily due to excessive man-caused mortality.
Response: As discussed in Chapter 3, Local Wildlife Species of Concern, the decline rate for black bears is primarily due to excessive man-caused mortality across the Beartooth

Face. There is no evidence to support a direct link of this decline to the SMC operation or the proposed SMC expansion.

28-7. The glaring inadequacies of the annual monitoring reports, and the failure to provide a forum for the public to understand the impacts that are occurring and the success or failure of monitoring programs, mitigation measures, or reclamation plans, must be addressed by the agencies. Appropriate monitoring and enforcement are critical to public trust in the agencies' abilities to do what they say they are going to do, to protect what they say they are going to protect. Otherwise, mitigation measures are meaningless.
Response: This EA has utilized the opportunity to address exactly what your comment proposes - that is, to inform the public of the results of the monitoring, and mitigation plans. The agencies agree that public participation in the process is extremely important and beneficial. However, it is obvious that after almost 10 years in the permitting process, miscommunications and misunderstandings still exist. The agencies would be very willing to meet with the public to explain what annual monitoring reports are; who writes them; how is information verified, and, in general, to try to clear up our mutual misunderstandings. The agencies are very aware of the value of public trust, and they do not take their stewardship responsibilities lightly. Little or no public comment has ever been received on the Annual Reports (environmental, not fiscal documents) which have been mailed to public interest groups, and no requests for general public information meetings have been previously received. Although agencies' budgets are limited, they have, and will continue to respond to requests for information. If the alternative for expansion with mitigation is chosen, then the full study of alternative habitat locations will begin, as discussed in Chapter 4, Alternative 5.

Northern Plains Resource Council, Letter #29

29-1. The Water Quality Bureau is in violation of its own rules in reviewing SMC's Montana Pollution Discharge Elimination System (MPDES) permit and its nondegradation petition for an exemption in the EA.
Response: The agencies believe that all applicable rules have been complied with.

29-2. The WQB is processing and reviewing petitions for nondegradation exemptions with rules that are disapproved by the US Environmental Protection Agency. (EPA)
Response: See comments of R. Parks, T-6.

29-3. The DSL and WQB can <u>not</u> grant "new and increased" sources of pollution a "mixing zones', nor can the water quality standards be exceeded in these zones.
Response: The DHES may grant a mixing zone (ARM 16.20.1010) to dischargers.

29-4. The EA lacks an analysis of water quality impacts if 1990 gpm is the actual amount of water draining from the mine.

Response: If greater than expected groundwater flows were encountered, SMC would be required to provide the same degree of treatment that would be applied to the projected flow. Therefore, additional impacts are not anticipated.

29-5. There is no detailed discussion of potential surface water losses that could result from the mine expansions.
Response: Surface water losses result when the mine opening intersects fractures or faults that are hydraulically connected to surface water bodies. This connection has already been demonstrated with the interception of No Name Creek. Continued mining will likely impact surface water resources in local areas. Because the exact location, orientation and permeability of fractures and faults are impossible to predict, the influence of mine expansion on specific surface water resources is equally difficult to predict.

29-6. Why is pre-mining water quality data conducted in the late 1970's and early 1980's left out of this document?
Response: The data was considered in the analysis and is on file with the agencies. It is not necessary to reprint all raw data.

29-7. There are not accurate assessments of off-site impacts of any of the proposed actions from the pollution of groundwater under the SVR ponds.
Response: The agencies believe that impacts to surface and groundwater have been adequately addressed in section 4.2.2.

29-8. A water protection/monitoring bond must be presented and explained in an EIS.
Response: The Water Quality Act does not have bonding provisions. The Metal Mine Reclamation Act does empower DSL to bond for all reclamation activities, including protection of water quality. Reclamation performance bonds generally account for the costs to monitor water quality, assuring approved parameters and sampling materials for a reasonable period of time following closure. Long term or perpetual monitoring, maintenance or treatment costs cannot be practically bonded for, as performance is not considered reclamation that can be achieved within a reasonable time period. However, if long term or perpetual costs are anticipated, the establishment of a separate trust fund would be required to generate the estimated annual costs of monitoring, maintenance and treatment.

29-9. There is no plan presented for what will be done with the sediment that collects in the SRV ponds either during operation or post-mine closure.
Response: Since the water that is discharged to the percolation ponds is clarified before disposal, very little sediment should accumulate. Any sediment retained in the percolation ponds is disposed of in the tailing impoundment.

29-10. Explain why SMC is requesting the standard for lead and chromium for groundwater to be .01 and .02 mg/l if the adit water quality only contains .007 and .0015 mg/l respectively.

Response: The concentrations requested in the petition were developed by SMC and are analyzed by the agencies in the environmental assessment.

29-11. How and where will habitat improvements take place if (as predicted) reclamation of the disturbed area and the tailings dam is not adequate or fails?
Response: The agencies are attempting to improve the reclamation plan based upon the advances made in reclamation since original permitting. The present plan would revegetate the site, but the improved plan would do it better. Alternate habitat improvement sites are not necessary for this purpose stated in the question.

The agencies are not predicting that reclamation will fail or be inadequate. We are saying that we can improve on the plan we have. The Metal Mine Reclamation Act would prohibit the State from granting a permit if the agencies believed that reclamation would fail.

29-12. The No Action alternative would not necessarily mean SMC would not have to file a nondegradation petition.
Response: Degradation applies to new or increased sources of pollution [ARM 16.20.701(1)]. Additional groundwater would not constitute an enlarged source of pollution.

29-13. The type and amount of chemicals used in weed control, and their effects on ground and surface water quality should be better analyzed.
Response: The environmental assessment addresses the impacts of the proposed expansion. Herbicides applied in accordance with manufacturer's instructions and state and federal standards are considered as best management practices (BMP).

29-14. There is no analysis of mine safety related to the expansion or alternation of the method of mining.
Response: Mine safety is regulated by the Mining Health and Safety Administration (MSHA), a federal agency. If MSHA finds hazardous conditions they will require modifications to reduce the hazards to an acceptable standards.

29-15. The EA does not show how it plans to ensure nondegradation from mine waste water discharges after the mine closes.
Response: Post-mining water quality would be monitored until surface and groundwater quality is within acceptable limits (section 2.5.1). Monitoring and pond maintenance would be included in the bond.

29-16. The proposed effluent limits in table 4.2.6 on page 123 violate surface water quality standards.
Response: The comment does not say what water quality standard would be violated; however, the effluent limits referred to do not violate any water quality standard.

29-17. SMC's proposal exceeds the maximum foreseeable development scenario in the USFS Integrated Resource Analysis.
Response: The Stillwater IRA calls for a predicted SMC expansion of 1500 TPD, and employment levels between 500 and 575 by 1993. These futuristic predictions are just that, predictions, and rely heavily on expected economic market conditions. The IRA established that its' predictions would be based on a steady market.

29-18. Page 9: Is a water right needed for SMC to withdraw and discharge the 700-1900- gpm likely to come from the mine?
Response: No. If SMC wished to appropriate this water, it would have to file for water rights which would be junior to all existing rights.

29-19. Page 4: Beginning on page 4 it is mentioned the tailings dam is "dewatered." How does this occur? Is leakage to groundwater the only process?
Response: Page 4 does not contain text describing dewatering of the tailing dam. The dam itself is dry, and constructed of waste rock and borrow material rather than tailing. Some reference is made throughout the EA to dewatering of the tailing mass. For example, it is anticipated that dewatering of the surface of the tailing mass will be required for reclamation access, and may be limited to partial desiccation to a few feet below the surface. Some dewatering will result from self-weight consolidation and consolidation due to placement of a reclamation cap; this volume of water would be extruded to the surface of the settled material. Ultimate long term dewatering is expected to occur as the synthetic liner deteriorates over time, and will involve the greatest volume of tailing water. Gravity drainage will reduce the moisture content in the tailing mass from saturation to specific retention, a property of material that retains some moisture within pore spaces and will no longer drain by gravity (related to particle size and capillary forces). The ultimate dewatered volume could range from 67 million to 96 million gallons. For more specific information, please refer to the discussion on seepage and draindown on pages 104 and 105 of the EA.

29-20. Page 40: What are the present percolation ponds maximum capacity? Could they handle 1900 gpm of inflow over time?
Response: Mine water discharges directly into two clarifier tanks, each having a capacity of 1500 gpm. Clarified water is then discharged to settling and percolation ponds. The 12 ponds have a combined infiltration area of about 116,000 square feet, and have a conservative average infiltration rate of .15 ft/hr. Therefore, the present clarification and pond system could handle a mine water discharge of 1900 gpm.

29-21. Page 59: The discharges to surface and ground water would contain concentrations higher than base line quality for lead, copper, chromium and nickel. This should be corrected on this page.
Response: The text has been modified to address the commenter's concern.

29-22. Page 62: How can the basin have a high average annual precipitation? What is the average? For what years?
Response: The statement in the EA is that there is a high variation in average annual precipitation. The intent is to describe the variability which may occur seasonally and annually (wet years versus drought years). See also the response to Comment 13-22.

29-23. Page 68: There is an example on this page of groundwater impacts from the land application of waste water, yet the rest of the EA downplays impacts to ground water. If a trend in groundwater quality impacts is developing why is it not explored and the impacts analyzed in the subsequent sections of this EA?
Response: As predicted in the original EIS, the concentration of some parameters in the vicinity of the mine would increase (see comments of J. Milligan, 13-1). The present EIS discusses the impacts from these constituents, and others, on beneficial uses in Chapter 4 - Environmental Consequences.

29-24. Page 71: How does SMC plan to minimize the contact of blasting compounds with water in the mine?
Response: It is unknown how SMC plans to minimize the contact of blasting compounds with mine water. However, it makes economical sense to keep explosives dry and powder magazines are usually drifted into dry rock. Acceptable fragmentation may be achieved with lighter explosive loads per blast hole, but miners tend to avoid under loading blast holes both for efficiency and safety reasons. Some contact with explosive residues and gases is unavoidable; for example, freshly blasted muck piles in production zones are wetted by sprinklers in order to suppress rock dust and powder gas. The minimization of contact between blasting compounds and water is a qualitative statement that cannot always be practically implemented.

29-25. Page 72-73: It is unclear how the value for lead in adit water in table 3.2.6 is measured to .01 mg/l when the following table 3.2.6 claims the composite quality is measured to .0004. Are different detection limits used? Both the dissolved and total recoverable values in table 3.2.5 are much higher. This confusion is the same for other metals presented.
If testing methods are different, how can the tables be compared? The EA claims dissolved metal are low, yet they are measured well above the detection limits here.
Response: Please refer to section 3.2.3 which discusses the different detection limits that have been used.

29-26. Page 76: What is the cation exchange capacity for the soils receiving the waste water? It the land application of waste water continues when would this capacity be reached and what is the affect on water quality, if exceeded?
Response: Alternative 5 requires the company to collect additional information on cation exchange capacity (CEC). The CEC value used in the analysis, for comparative purposes, is less than 5, the lowest category. At the projected rate of application, metal concentrations would not exceed recommended loads for 125 to 500 years.

29-27. Page 97: What would be the impacts to Still Water Co. if the expansion increases the county's economic dependance on SMC? What if the mine closes due to economic reasons? What are the lowest market prices for platinum and palladium that would cause SMC to shutdown because the mine would not longer be profitable? These issues should be addressed in an EIS.

Response: Information on the effects of the mine expansion on the structure of the local economy has been added to the Socioeconomics section of Chapter 4. A determination of the platinum and palladium prices at which the mine would be unprofitable is beyond the scope of a MEPA/NEPA analysis.

29-28. Page 98: How much does SMC pay in Metal Mine license taxes, what are it gross proceeds? How much is it 40% share? How long would this money last to help the affected counties if the mine were to close?

Response: In 1991 some of SMC's taxes were:

$685,477	Metalliferous Mine License (1.5% of gross value)
348,877	Gross Proceeds (3% of gross values - no deductions for production costs
825,900	Property taxes
370,294	pre-paid property taxes (for FAS 419 bridges)

It also paid Resource Indemnity Trust (0.5% of gross value)
Corporate License Tax (6.75% of net income)
The county receives 1/3 of the Metalliferous Mines Tax under the Hard Rock Impact Act (HRIA). Forty percent of the county's share or about $70,000 in 1991 is deposited in an interest bearing trust fund which can only be used if 50% or more of SMC's work force were to be laid off. Under provisions of the Hard Rock Impact Act these funds can be used at the discretion of the local government officials: to aid the schools; for planning and economic development to create jobs; to stabilize the tax base by reducing bonding indebtedness, etc.

29-29. Pages 108-110: The seriousness of changes in the tailings dam require and EIS. If a 1/2 to full PMF flood occurred the safety and integrity of the dam would be compromised. A full plan of options needs to be presented in an EIS to address these issues.

Response: Of the tailing impoundment alternatives analyzed, only alternative 3d (raised embankment while maintaining 2h:1v slopes) would intrude farther into the floodplain than the existing approved design. The consequences of the improbable occurrence of the one-half or full probable maximum flood were analyzed in the original EIS. It is agreed that further intrusion into the flood plain (i.e., alternative 3d) would require additional analyses. Please refer to paragraph six on the bottom of page 110.
Total failure of the dam means that the structure is damaged beyond repair or future use. In the case of design floods, erosion of the dam toe by turbulent flow along the base should not erode tailing material, as the base of the dam averages greater than 500 feet thick. Subsequent mass instability of the slopes could follow toe erosion by floods, but the tailing mass itself would not be expected to flow (please refer to paragraph one at the top of page 108).

The recurrence interval of the design floods are estimated at 10,000 to 30,000 years, and the design criteria and location of the existing dam toe are considered to be reasonable with the given probability and risk.
For related information, please refer to the response to Comment 4-1.

29-30. Page 114: When will a storm water permit be needed?
Response: The current deadline for stormwater permits is October 1, 1992.

29-31. Page 116: The definition of nondegradation is misleading. Nondegradation of standards are designed to prevent incremental increases and preserve present water quality. Degradation is not defined, legally, as a violation of the standard-this should be corrected.
Response: Degradation was appropriately defined, but has not been clarified.

29-32. Page 120: If the requested groundwater standard for nitrate is 8 mg/l, pg. 40, how is it justified on page 120 that it may exceed 10 mg/l? This is illegal in light of the fact that the state rule allowing this is in violation of federal law.
Response: The value of 10 mg/L for nitrate in the discharge is an average value. Based on conservative estimates of the amount of groundwater available for mixing, standards will not be violated.

29-33. Page 125: If SMC would be responsible for treatment before the presumed MPDES limits are achieved, why is this treatment method not presented? This "method" would add additional impacts and affect SMC's overall proposal. This must be fully covered in an EIS.
Response: All available treatment technologies are discussed, please refer to section 2.5 and 4.2.2.

29-34. Page 129-120: How would the state know if standards were exceeded if detection limits are above the standard?
Response: Detection limits used for groundwater monitoring are lower than all applicable standards. Some surface water standards are not achievable with approved procedures. Alternative 5 would require SMC to monitor surface and groundwater quality using the lowest achievable detection limits using approved procedures.

29-35. Page 132: Given the fact that the 1900 gpm scenario is not analyzed, how can the cumulative impact statement claiming minimal impacts be supported?
Response: The given range of permanent mine water discharge is 700 to 1900 gpm. Because the source of nitrates is fixed by blasting during the production life of the mine, mass loading and degradation would be unchanged. In other words, analyses using the upper range of estimated discharge volume would result in diluted concentrations. Following cessation of operations, the mine water quality is expected to approach ambient levels regardless of the discharge volume.

29-36. Why is the precedent setting nature of the petition not mentioned under the cumulative impacts as required under MEPA, ARM 26.2.644 (1)f and NEPA 40 CFR 1508.27 (b) (6)

and the USFS IRA. If detection limits do not reach the development of the area and the cumulative impacts of this petition. "Metal concentration would reasonably be expected to increase as a result of other mining activities in the basin" pg.132. This contradicts other statements in the EA and is ignored in the cumulative analysis of how this may affect future actions.

Response: It is not clear what the precedent-setting nature is. The BHES has considered and granted other petitions to allow degradation.

P.H. Jaquith Letter #30
Red Lodge, MT

30-1. In 2.5.3 4-C page 45 3rd paragraph. It states that if the petition {Sic} is denied, SMC would have to submit a plan to the agencies...prior to approval by the agencies. yet on page 44, paragraph 6, the discussion indicates that the agencies could well make a decision prior to that of BHES.

Response: The text has been clarified to reflect the actual sequencing of decisions. That is, following a BHES decision on the petition, the Forest Service and DSL will prepare a Record of Decision.

30-2. 2.6.1-2 page 48 Additional Groundwater Monitoring: Since effects of the present operation on water resources outside the permit boundary are unknown, it would seem that the existing pattern of monitoring wells is not adequate. The agencies should know with a high degree of certainty what, if any, effects are present from the 1000 T/day operation prior to increasing the output to 2000 t/day.

Response: The effects of the current operation are known and are consistent with those predicted in the original EIS.

30-3. Chapter 3, page 78-wildlife. The EA would be more meaningful if the data used was updated to 1991. The 1985 data reference is inadequate to base a decision regarding effects on bighorn.

Response: The data referred to in this text is 1991 data. The 1985 EIS and 1970's and 1980's data is for baseline information to show trends from these dates to the present time.

30-4. Pg 109-Option 3d line 8 & 9. Probability of dam failure exists but that impact would be negligible in relation to regional flooding-except that the dam holds a huge volume of chemicals and this surge downstream, could well be significant.

Response: Structural damage to the dam is expected to occur in the event of the one-half or full probable maximum flood. However, the base of the embankment averages greater than 500 feel thick, and the failing mass would probably not be immediately affected by a design flood event for alternatives 3a, 3b, and 3c. The design flood plain elevations and the estimated recurrence materials of 10,000 and 30,000 years, respectively, suggest that the risk is reasonable for these alternatives.

The comment is accurate with respect to alternative 3d, and though the chemicals in the failing mass and effluent are relatively innocuous, and would be greatly diluted and distributed after mixing with a design flood event. The technical author agrees that further intrusion into the design event flood plain with alternative 3d would be imprudent disregard of the original design criteria, with possible significant consequences. Please note that further intrusion into the design flood plain was not proposed by SMC; alternative 3d was developed by the agencies, and flood plain intrusion is recognized as a serious shortcoming of this alternative.

Noel & Penny Keogh Letter #31
Red Lodge, MT

31-1. If SMC is allowed to degrade the water quality to state drinking water standards, will this restrict the future development of plans of Chrome Corp of America or those in the Cooke City area, or any other developments that may effect {sic} water quality. Are we giving SMC the exclusive right to pollute to the limit?
Response: SMC has not applied to degrade up to state drinking water standards.

31-2. The increased slope and rubbled surface of the dam face will create an impossible environment to control the inevitable Spotted Knapweed infestation this will create.
Response: SMC has an approved weed control and aggressively eradicates weeds on site. The company's responsibility continues until the final reclamation bond is released. After that, weed control would be the responsibility of the landowner. The chances are just as great that weeds would invade a vegetatively reclaimed slope as a rock armored slope. This is because the mine is not the only seed source. Noxious weed control is everybody's business.

Jack Heyneman, Letter #32
Fishtail, MT

No additional substantive comments.

Susan Heyneman Letter #33
Bench Ranch
Fishtail, MT

No additional substantive comments.

Al Kampmeyer Letter #34
Greensboro, MD

34-1. I have great concerns about the integrity of the liner. The welds are adequate; the few that were lab tested by Gundle indicate good welds, but these are not representative of the pressure testing conducted on each seam on each sheet in the entire impoundment lining.

Leakage is more like hundreds-thousands times more than indicated in the assessment and a larger value should be used in any ground water modelling.

Response: The standard defect of a 1/8 inch diameter hole per acre of lined surface is taken from statistical research conducted by the EPA, and is conservative for a 100 mil HDPE liner. In addition, the low permeability of the tailing mass covering a line defect would greatly reduce the amount of flow to the defect. Fluid flow through liner defects that are covered by ponded effluent only and no tailing material would be considerably greater, but these areas are small compared to the total pond area.

The assumptions used in the seepage analysis are considered reasonable and are reinforced by data from the seepage monitoring systems. Please refer to the seepage discussion of pages 104 and 105 of the EA for additional information.

Torian Donohue, Letter #35
Gt. Falls, MT

35-1. It is imperative that a programmatic EIS be prepared that will comprehensively address the impacts of large scale mining and processing operations in the area.

Response: A programmatic EIS is one which evaluates a class of actions having cumulative impacts. In that there are no other mines proposed to overlap the Stillwater Mine in time or space, a programmatic EIS would be purely speculative at this time. The cumulative impacts of existing operations have been addressed, as appropriate to the resource in this document. Thus "programmatic" is not appropriate for the existing activity.

The Custer and Gallatin National Forests completed an Integrated Resource Analysis in 1991 which evaluates mineral potential of the Stillwater Complex.

35-2. Stillwater Mining's (SMC) proposed development abrogates commitments made by the company and the state in the initial EIS released in 1985. That document stated that the water quality of the Stillwater River would remain unaffected by SMC's operations, seven years later that promise means nothing, as evidenced by the company's petition for an exemption under the state's nondegradation policy.

Response: SMC has not applied for an exemption to the state nondegradation policy; they are complying with the nondegradation policy and rules. Also see comment 13-1, J. Milligan, Stillwater Protective Association.

James Phelps, Letter #36
Billings, MT

No additional substantive comments.

Joseph E. Heigis, Letter #37
Nye, MT

37-1. How can ones that contribute so little to the county have such a loud voice?

Response: All persons have the right to be heard during scoping, to comment on environmental documents, and if they don't like the decision, to appeal it.

Montana Department of Fish Wildlife & Parks, Letter #38
K.L. Cool, Director

38-1. The inference (p. 143) that nutrients are a fertilizer that will benefit the fishery is inappropriate. Such blooms change the pristine characteristics of rivers such as the Stillwater and can negatively affect recreational quality and fishery resources. We recommend that the mine conduct the site specific studies necessary to determine (nitrate = nitrite) thresholds for the Stillwater River. Loren Bahls of the Water Quality Bureau can provide the information needed to conduct a site specific study.

Response: 1. The DHES has reviewed a number of studies addressing nutrient addition, algal growth rates, standing crop and community composition. Although these studies are very useful, they have limited application in predicting the impacts of the proposed mining operation for a number of reasons. These studies have been conducted in artificial channels, in the absence of invertebrate consumers and other growth limiting factors. These factors add an additional degree of uncertainty in predicting nutrient impacts. Studies on the Clark Fork, and similar work in British Columbia, have demonstrated, that nitrates in the presence of bioavailable phosphorus (approximately 0.040 mg/L) can stimulate algal growth at concentration of 0.250 mg-N/L, or less. All of these studies have added nitrogen and phosphorus simultaneously. A concentration of 0.250 mg-N/L actually saturates algal growth, that is, algal growth is maximized; additional nitrogen will have little or no effect. The total phosphorus concentration of Stillwater River ranges from less that 0.010 to 0.07 mg-P/L. Generally, less than half of this is bioavailable. The SMC discharge will not add phosphorus to the surface or ground water (specified in MPDES permit).

The agencies have considered these factors and share the DFWP's concern for protection of these resources. Montana Water Quality Standards prohibit the growth of undesirable aquatic life (ARM 16.20.633(1)(e). It is the judgement of the DHES, that if total inorganic nitrogen is not allowed to exceed 1.0 mg/L, the Stillwater River will not experience undesirable algal blooms. The decision to allow any increase nitrogen concentrations will be made by the BHES.

The reference to nutrients benefiting the fishery was inappropriate and has been deleted.

The agencies, under Alternative 5, have developed a biological monitoring program to assess algal biomass and standing crop. The agencies welcome DFWP input and review of the biological monitoring plan.